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TO:

Jerald Roseburg

North Central Region, Wenatchee

FROM:

T. M. Allen/A. J. Fiske

E&EP Geotechnical Division, 47365

SUBJECT: US-2, CS 0403, MP 103.8 to 104.8, XL – 2072

Peshastin East - Interchange

Geotechnical Report

Attached with this memorandum is the geotechnical report for the East Interchange project in Peshastin, Washington. This report presents the results of our geotechnical investigation for the Peshastin East Interchange project. Geotechnical recommendations are given in this report for the design of spread footings for both the US-2 overcrossing of US-97 and the equipment underpass along Blewett Cutoff Road, including design parameters for abutment and wing or curtain walls, approach slab recommendations, recommendations for construction of embankments and cut slopes.

When the PS&E is completed for this project, our office will provide a *Summary of Geotechnical Conditions* for inclusion in the Special Provisions. If you have questions regarding information, please contact Tony Allen at 360.709.5450 or Andrew Fiske at 360.709.5456.

TMA: ajf

cc: Erik Howe, North Central Region, Wenatchee Joel Voth, North Central Region, Wenatchee Eric Schultz, EEP Bridge & Structures, 47340

#### **GEOTECHNICAL REPORT**

## **Peshastin East Interchange**

XL-2072

Tony M. Allen, P.E.

State Geotechnical Engineer

Prepared by

Andrew J. Fiske

Geotechnical Engineer

Reviewed by:

James G. Cuthbertson, P.E.

Chief Foundation Engineer

August 4, 2005



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Washington State
Department of
Transportation
Douglas MacDonald
Secretary of Transportation

Environmental and Engineering Programs Division Materials Laboratory Geotechnical Division P.O. Box 47365 Olympia, WA 98504-7365

## **Table of Contents**

1.	INTRODUCTION	1
1.1.	GENERAL	1
1.2.		
2.	GEOLOGIC SETTING	1
2.1.	Regional Geology	1
2.2.		
3.	SITE CONDITIONS	2
4.	FIELD EXPLORATION	2
4.1.	SUBSURFACE EXPLORATION	2
4.2.		
5.	SITE SOIL CONDITIONS	4
6.	SURFACE AND GROUNDWATER	5
7.	SEISMOLOGICAL CONSIDERATIONS	5
7.1.		
7.2.		
7.3.		
7.4.	LIQUEFACTION POTENTIAL	6
7.5.	LIQUEFACTION INDUCED LATERAL SPREADING	7
7.6.	FAULT RUPTURE	7
8.	GEOTECHNICAL RECOMMENDATIONS	7
8.1.	GENERAL	7
8.2.	EARTHWORK RECOMMENDATIONS	8
8.	3.2.1. Embankments	
	3.2.2. Permanent Cut Slopes	
	3.2.3. Reuse of Onsite Materials	
8.3.		
8.	3.3.1. Spread Footings	
	8.3.1.1. US-2/US-97 Bridge Piers 1 and 2 Abutments	9
	8.3.1.3. Spread Footing Resistance Factors	9
	8.3.1.4. Spread Footing Equivalent Spring Constants	
8.4.		
8.5.		
8.6.		
9.	CONSTRUCTION CONSIDERATIONS	
9.1.	FOUNDATION EXCAVATIONS	11

9.2. 9.3.	TEMPORARY SLOPES AND SHORING	
10.	CLOSURE	
11.	REFERENCES	12
APP	ENDIX A: Boring and Test Pit Logs	
APP	ENDIX B: Laboratory Test Results	
APP	ENDIX C: Images of Recovered Core Samples and Test Pit Excavation	
APP	ENDIX D: Foundation Capacity Charts	
List	of Figures	
1.	Vicinity Map	
2.	Site and Exploration Plan	
3A.	Generalized Geologic Profile US-2 A-Line Station 30+00 to 56+00	
3B.	Generalized Geologic Profile US-2 A-Line Station 56+00 to 80+00	
4.	Generalized Geologic Profile US-97 B-Line Station 51+24 to 83+16	
5.	Bridge Site and Exploration Plan	
6.	Bridge Elevation View with Generalized Geologic Profile	
List	of Tables	

- Spread Footing Resistance Factors 1.
- 2. Shear Modulus versus Foundation Strain
- Lateral Earth Pressure Coefficients and Soil Parameters 3.

#### 1. INTRODUCTION

#### 1.1. GENERAL

This report presents the results of our geotechnical investigation for the Peshastin East Interchange project (Peshastin East I/C). Geotechnical recommendations are given in this report for the design of spread footings for both the US-2 overcrossing of US-97 and the equipment underpass along Blewett Cutoff Road, including design parameters for abutment and wing or curtain walls, approach slab recommendations, recommendations for construction of embankments and cut slopes. A vicinity map illustrating the project location is presented in Figure 1. When the PS&E is completed for this project, our office will provide a Summary of Geotechnical Conditions for inclusion in the Special Provisions.

The analyses, conclusions, and recommendations in this report are based upon 13 borings and 1 test pit completed specifically for the project, published geologic information for the site and vicinity and our experience with similar geologic materials. The exploratory borings and test pit are assumed to be representative of the subsurface conditions throughout the project area. If during construction, subsurface conditions differ from those described in the explorations, we should be advised immediately so that we may reevaluate our recommendations and provide assistance.

#### 1.2. PROJECT DESCRIPTION

The main objective of the proposed project is to relocate the existing at-grade intersection of US-2 and US-97 approximately 1100 ft to the west. This will be accomplished by raising the existing US-2 alignment and lowering the new US-97 alignment. A new bridge will then carry US-2 over US-97. The proposed alignments are shown, in Figure 2. The new interchange will be a diamond interchange with US-2 crossing over US-97.

Approximately 4000 ft (Sta. A31+50 to 72+50) of existing US-2 are affected by the new project. The new alignment for US-2 is higher than the existing; therefore the proposed US-2 alignment consists wholly of fill sections. The fills are up to 10 ft in height.

The project will require approximately 2000 ft (Sta. 52+00 to 72+14) of new alignment for US-97, as it approaches the intersection. In addition, there will be about 1300 ft (Sta. B72+14 to 85+33) of new alignment along the B-line north of the new bridge. This additional alignment will be for realignment of Jeski Road, see Figures 1 and 2. Most of the new alignment for US-97 will be in cut (Sta. B50+00 to 83+00). The cut depths range up to about 25 feet. There are also fills up to about 20 ft high between stations 54+00 and 58+50.

An equipment crossing is also proposed to go under US-2 at Sta. A41+97.6. A new bridge will carry US-2 over the proposed equipment crossing.

#### 2. GEOLOGIC SETTING

#### 2.1. REGIONAL GEOLOGY

Most of the discussion regarding the regional and site geology was adopted from Dragovich et al (2002), and Tabor et al (1987).

The project site is located within the Cascade Range, which is bounded to the east by the Columbia Basin and Okanogan Highlands, and to the west by the Puget Lowlands. Structurally, the site lies on the western edge of the Chiwaukum Graben, which is between the Leavenworth and Entiat Faults. These faults are not considered to be active. The Chiwaukum Graben is located within a broader segment of the valley floor, and is part of the Wenatchee drainage basin. The Wenatchee drainage basin is typically dominated by deposits related to alpine glaciers and alluvium. These deposits generally consist of inwash or outwash material, which can range from poorly sorted gravelly sand or sandy gravel to well-sorted pebble gravel and cobble gravel.

#### 2.2. SITE GEOLOGY

Surface sediments at the site are mapped as Pleistocene terrace gravel (Qtg) by Tabor, et. al. and Late Wisconsian alpine outwash (Qao) by Dragovich, et. al. Pleistocene terrace gravel is described as moderately sorted cobble to pebble gravel. Late Wisconsian alpine outwash is described as stratified sand and gravel which can locally contain silt and clay. These soil units are partly but not wholly inwash and/or outwash originating from alpine glaciations. As discussed below, the borings confirm these descriptions of the material's particle size.

#### 3. SITE CONDITIONS

The site lies approximately 1 mile west of the confluence of Peshastin Creek and the Wenatchee River, at a location where the river valley is nearly a mile wide. In the vicinity of the site, the Wenatchee River flows from the northwest to the southeast. However, about a half mile northwest of the site, along US-2, the river makes an abrupt turn to the northeast resuming its southeasterly direction after about a half mile. Much of the site is currently occupied by orchards and low density residential development. It is probable that the entire site along the proposed US-97 alignment has been cultivated in the past. There are no major surface streams crossing the site. The major surface streams adjacent to the site are Peshastin Creek, which borders the site to the south, and the Wenatchee River, which borders the site to the north and east.

#### 4. FIELD EXPLORATION

#### 4.1. Subsurface Exploration

The exploration plan consisted of thirteen borings drilled to depths of up to 51.3 feet below ground surface (bgs), and one test pit excavated to approximately 12 feet bgs. Borings H-1-04 through H-3-04 were completed in February of 2004, Borings H-4-04 and H-5-04 were completed in July of 2004, and Borings H-6-04 through H-13-04 and the test pit were completed in October and November of 2004. Plan locations of the borings and test pit are shown on Figure 2. Piezometers, were installed in Borings H-1-04 through H-5-04 and H-7-04 through H-9-04. The installation of data loggers and piezometer monitoring results are separately discussed below.

Geotechnical drilling was performed using a CME 850 track-mounted drilling rig. The borings were drilled principally using wet rotary methods, and standard penetration testing (SPT) was done at approximately 5 foot intervals, in general accordance with American Society of Testing and Materials (ASTM) D-1586. SPTs are obtained by driving a 2-inch outside diameter split-spoon sampler 18-inches into the soil with a 140-pound hammer. The number of blows required

to achieve 6 inches of penetration is recorded and the soil's SPT resistance, or N-value, is calculated as the number of blows required to achieve the final 12 inches of penetration. The drill rig is equipped with an automatic trip hammer to drive the split-spoon sampler. The automatic hammer on this drill rig is rated at approximately 75 to 80 percent efficiency, as compared to 60 percent for manual hammers. Large diameter (3 inch) penetrometers were occasionally used in the gravel layer, which is discussed below, in attempts to recover a more representative sample. It is noted in the boring logs where the large diameter penetrometers were used.

Hollow stem augering was attempted at the site. In boring H-1-04 cobbles and boulders were encountered at a depth of about 8 ft and the hollow stem auger refused at a depth of 10.5 feet. Below this depth it was necessary to switch to cased drilling methods. Cased methods were used for the remainder of the borings. The use of coring methods to penetrate large boulders was required in the majority of the borings. Several images of core samples that were recovered are shown in Appendix C. Standard penetration testing was done between each core run.

The test pit was conducted to provide direct visual observation of the consistency and grain size of the material into which the cuts will be made, and to correlate the near surface soils observed in the test borings. Representative bulk soil samples were collected from the test pit. Images of the excavated test pit is shown in Appendix C.

The explorations were surveyed by the North Central Region to record boring location and elevation. The explorations were continuously monitored, logs of subsurface conditions were maintained, and representative samples were collected. The soils collected were visually classified based on modified procedures as outlined in ASTM D-2488. Logs for the borings and test pit including a key for their symbols are contained in Appendix A. The edited logs of the test borings and test pit should be made available to all prospective bidders and included in the contract documents.

#### 4.2. LABORATORY TESTING

Laboratory testing was performed on selected samples from the field exploration program. Only disturbed samples were recovered from the site. Disturbed samples are those obtained during the SPT, or as bulk samples from a test pit. The disturbed samples were used for classification and index property testing. Only limited testing was done on material recovered from SPT tests in the gravel layer because, in our opinion, the material recovered in these samples was not representative of the actual grain size distributions present in the soil mass. As previously mentioned, some core samples were recovered.

For each boring, all of the soil samples were visually examined and then grouped together based on particle size distribution, consistency, and color. Once groups of samples were established that had similar characteristics, a minimum of one sample per group was tested. Exceptions to this were many of the gravel samples recovered, as discussed above. The testing consisted of performing moisture content determinations, particle size analyses and, if applicable, determining the Atterberg Limits.

As discussed above, the disturbed samples obtained during the SPT in the gravel layer were not, in our opinion, representative of the actual grain size distributions present in the soil mass. In particular the samples do not represent the large fraction of cobble and boulder size material that

is present. The presence of cobble and boulder size material in the gravel layer is evidenced by the material recovered during coring (see images in Appendix C), the test pit excavation and by the behavior of the drill. Additionally, the presence of the cobbles and boulders in the gravel layer is consistent with the glacial deposition environment of the material. In order to obtain representative grain size distributions and a qualitative estimate of the difficulty expected during excavations for roadway cuts and/or structure foundations, we excavated the test pit described above. Bulk samples of the material from the test pit were collected and grain size distributions determined.

The tests were done in accordance with AASHTO T-88, T-89, and T-90 guide specifications, respectively. After the testing was complete, the samples were classified using the Unified Soil Classification System (USCS). All laboratory test results are presented in Appendix B.

#### 5. SITE SOIL CONDITIONS

Generalized subsurface profiles for the proposed bridge alignment, US-2 alignment from Sta. A30+00 to 80+00 and US-97 alignment from Sta. B51+24 to 83+16 illustrating subsurface data, interpreted conditions and SPT N-values, are provided in Figures 3, 4 and 6. The soil deposits encountered in the test borings and test pit have been grouped into three soil units for geotechnical distinction. The soil units are grouped primarily on the basis of engineering properties and classification and, in general, reflect depositional environments as well. The units are individually described below and abbreviated descriptions also appear on Figures 3, 4 and 6.

Unit 1 – Sand with Silt and Clay lenses: This unit consists of loose to medium dense sand with varying amounts of silt and gravel. There appear to be some distinct lenses of silt and lean clay, as observed in H-1-04, H-2-04, H-3-04, H-9-04, H-11-04, and H-13-04. The silt and lean clay layer varies in thickness from about 2 feet at H-2-04 to 7 feet at H-11-04 and occurs immediately above a gravel layer (described below); the lateral extent of the silt and lean clay layer is not known. The thickness of the sand with varying amounts of silt and gravel varies from about 13 feet at H-1-04 to 0 feet at H-6-04, and is typically about 5 feet thick. The low relative density in the upper 5 ft is likely a consequence of the cultivation that was discussed Section 3.0.

Unit 2 – Gravel with Silt and Sand: This unit directly underlies Unit 1, and consists of dense to very dense gravel with varying amounts of silt, sand, cobbles and boulders. As evidenced by the necessity of using coring techniques at various elevations, the gravel layer is characterized by a large fraction of cobble and boulder size material. Several images of material recovered from coring operations and test pit excavation are contained in Appendix C. As discussed above, the samples recovered using the split spoon sampler are not considered to be representative of the actual grain size distribution of the gravel layer. Also, the presence of the gravel and larger sized material may have artificially inflated the blow counts recorded on the boring logs and Figures 3, 4 and 6. The recovered samples within the gravel layer consisted primarily of a green to black granitic rock that occasionally appeared to be schistous. This unit was observed to completion in H-1-04 through H-4-04, H-6-04, H-8-04 through H-10-04, H-12-04, and TP-1-04.

Unit 3 – Silty Sand: This unit underlies Unit 2 in H-5-04, H-7-04, H-11-04 and H-13-04. It generally consists of dense to very dense sand with varying amounts of silt. The lateral

extent of the silty sand layer is not known. This unit was observed to boring completion in the above referenced borings.

#### 6. SURFACE AND GROUNDWATER

At the time of drilling, all thirteen of the borings were dry. Piezometers, were installed in Borings H-1-04 through H-5-04 and H-7-04 through H-9-04. Since the borings were dry, there was some debate regarding the necessity of installing the data loggers in the piezometers. It was decided to install the data loggers in the borings H-1-04 through H-3-04 order to determine whether there are seasonal fluctuations of ground water into elevations that are within the project limits. Data loggers were installed in borings H-1-04 and H-3-04 on March 9, 2004. The data logger for boring H-2-04 was installed on March 18, 2004. Water levels were recorded at the time the data loggers were installed. The data loggers were removed in April of 2004, and the water level in all of the piezometers were manually read.

The monitoring plan was to obtain monthly readings for at least one year. The actual reading of the data loggers was accomplished by personnel from the North Central Region Materials Laboratory. The recovered data was forwarded to our office for interpretation and recording.

At the time of this report groundwater was observed in H-2-04 at 32.9 feet bgs and H-3-04 at 28.5 feet bgs as seasonal highs in March of 2004. In all the remaining piezometers groundwater was not observed.

Surface water observed adjacent to the project site include the Wenatchee River to the northwest and Peshastin Creek to the southeast of the proposed interchange. The Wenatchee River is approximately 500 feet from the proposed storm water pond on the northwestern side of the project.

#### 7. SEISMOLOGICAL CONSIDERATIONS

#### 7.1. REGIONAL SEISMICITY

The tectonic structure and stresses in Western Washington are mostly associated with the subduction of the Juan de Fuca Plate under the North American Plate. Under the framework of the subduction zone, the region can be divided into three tectonic provinces: (1) the Juan de Fuca Plate, (2) the continental forearc on the western edge of the North American Plate, and (3) the landward continental volcanic arc. Determining regional faulting and structural trends, especially in the Puget Lowland, is greatly complicated by the deep glacial and non-glacial soil deposits that mask the bedrock.

Within this tectonic environment three potential seismic sources can be identified. Interplate and intraplate seismic activity associated directly with the subduction of the Juan de Fuca Plate under the North American Plate, seismic activity associated with the volcanic arc and shallow crustal earthquakes.

Interface, or subduction zone, earthquakes take place at the boundary of the Juan de Fuca and the North American Plates. Although a subduction zone earthquake has not been recorded off the coast of Washington or Oregon during historic time, geologic evidence suggests that they may occur. The last great earthquake to occur on the interface zone appears to have occurred around

1700. Studies of recurrence suggest that the average recurrence interval is about 450 years with a 90 percent confidence interval of about 200 years. A magnitude M8 to M9 earthquake is believed possible along the subduction zone; however, the best estimate is M8.3 (USCOE, 1994 and Geomatrix, 1995).

Intraslab earthquakes take place within the subducting Juan de Fuca Plate between depths of 40 to 60 km. These earthquakes occur inland from the interface earthquakes. Intraslab earthquakes have occurred in the Puget Sound region, with six historical earthquakes having magnitudes greater than 6. The largest earthquakes include the 1949 magnitude 7.1 Olympia earthquake, the 1965 magnitude 6.5 Seattle-Tacoma earthquake and the 2001 magnitude 6.8 Nisqually earthquake. The recurrence interval for intraslab earthquakes is highly uncertain. However, Geomatrix (1995) suggests 1,000-year and 5,000-year recurrence intervals for M7 and M7.5 intraslab earthquakes, respectively.

The third major type of earthquake is the crustal earthquake, which occurs in the North American Plate, typically at depths between 6 and 12 miles. Several earthquakes, between M4.0 and M5+, have occurred in the Cascade Range over the past 150 years. The maximum expected magnitude for a crustal earthquake varies throughout the state and depends on the thickness of the crust and the length and rate at which seismic strain accumulates on faults.

#### 7.2. SITE SEISMICITY

The site is located within the Cascade Range, and is therefore most likely to be subject to crustal earthquakes as described above. The site lies on the western edge of the Chiwaukum Graben, which is between the Leavenworth and Entiat Faults. These faults are not considered to be active. The closest potentially active faults according to the 2002 United States Geological Survey (USGS) probabilistic hazard maps are a minimum of 30 miles from the project site.

#### 7.3. Design Earthquake Parameters

For seismic design, a peak ground acceleration of 0.12g is recommended in accordance with the WSDOT Bridge Design Manual (BDM). This peak ground acceleration is consistent with the USGS map of Peak Acceleration with 10% Probability of Exceedance in 50 Years, as revised in 2002. Design response spectra presented in the AASHTO LRFD Bridge Design Specifications (2005 interim) for seismic design of highway bridges are considered appropriate for seismic design of the structures on this project. A type I soil profile response spectrum, with a site coefficient of 1.0 is recommended for seismic design of the proposed structures.

#### 7.4. LIQUEFACTION POTENTIAL

The liquefaction potential of saturated soils is evaluated mainly on soil gradation, density, and the depth of the deposit. The potential for liquefaction is highest for loose, fine to medium grained sands and silty sands. Increasing fines content (i.e., silt and clay) decreases the potential for liquefaction. Conversely, clean coarse grained granular soils are less susceptible to liquefaction due to their high permeability. The potential for liquefaction also decreases with increasing density and depth.

We have evaluated the potential for liquefaction of the project soils based on the SPT data obtained from the field explorations and the percentages of silt. Our analysis indicates that the

potential for liquefaction is low for the US-2 overpass structure and the equipment under crossing bridge.

#### 7.5. LIQUEFACTION INDUCED LATERAL SPREADING

Due to the absence of liquefiable soils at the site and/or their location above the ground water table, we consider the risk of lateral spreading during an earthquake event to be insignificant.

#### 7.6. FAULT RUPTURE

The potential impacts of fault rupture include abrupt, large, differential ground movements and associated damage to structures that might straddle a fault, such as a bridge. WSDOT recognizes that due to the limited number of mapped active faults and frequent presence of thick soil overburden, the ability to identify potential surface expressions of faulting is unreliable at this time. As discussed above, the closest potentially active faults according to the 2002 USGS probabilistic hazard maps are a minimum of 30 miles from the project site. In our opinion the risk of fault rupture is low across the project site.

#### 8. GEOTECHNICAL RECOMMENDATIONS

#### 8.1. GENERAL

We understand the new US-2/US-97 Bridge and equipment crossing structure under US-2 will be designed using Load and Resistance Factor Design (LRFD) methodology. Based on the soil conditions observed during our field exploration program, we recommend supporting the structures on spread footings. The primarily reasons for recommending spread footings are:

- 1. Subsurface conditions would make the installation of drilled shafts very difficult and the installation of driven piles virtually impossible (at least to the depths that would needed for lateral loading/deflection requirements).
- 2. There will be adequate room to excavate for installation of the footings and additionally large cuts are already required at the bridge site, for the new alignment of US97.
- 3. Groundwater is not expected therefore it will not complicate excavations for the footings.
- 4. There will be less likelihood for construction claims.

Design recommendations for spread footings, including nominal resistances for service, strength, and extreme limit states are provided in Section 8.3.

Design recommendations for the permanent cut slopes, roadway embankments and bridge approach embankments are provided in Section 8.2.

#### 8.2. EARTHWORK RECOMMENDATIONS

#### 8.2.1. Embankments

Embankments planned for this project include approximately 4000 feet (Sta. A31+50 to 72+50) of US-2, and approximately 450 feet (Sta. B54+00 to 58+50) of US-97. The embankments associated with the new alignment of US-2 are up to 10 ft in height, and the embankments associated with the new alignment of US-97 are up to 20 ft in height. Based on our test borings, we estimate construction settlement of new embankments will not exceed 1 inch, providing the subgrade is prepared as described in Section 2-06.3(1) of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications). We estimate nearly all of the settlement will occur during and immediately following placement of the new fill. Providing embankments are constructed in accordance with the Standard Specifications, the 2H:1V (horizontal:vertical) and 6H:1V slopes that are proposed for the roadway embankments will have an acceptable factor of safety against global failure during static and pseudo-seismic conditions. Final slopes on the roadway embankments should be 2H:1V or flatter, as shown in the plans. If steeper slopes are desired our office should be contacted for further recommendations.

#### 8.2.2. Permanent Cut Slopes

Permanent cut slopes planned for this project include most of the new alignment for US-97 betweens Sta. B50+00 to 83+00. The cut depths range up to about 25 feet. Based on our test borings and subsequent analysis, the 2H:1V slopes that are proposed for the permanent roadway cuts will have an acceptable factor of safety against global failure during static and pseudo-seismic conditions. Final cut slopes should be 2H:1V or flatter and rounded in accordance with the WSDOT Design Manual, as shown in the plans. Seepage is not expected from the face of the cut slope. If seepage is observed or steeper slopes are desired our office should be contacted for further recommendations.

Establishing vegetation on permanent cut slopes as soon as possible will aid in the prevention of short-term and long-term erosion. However, it should be noted that it may be difficult to establish vegetation on these slopes due to the lack of silt in the native soil that is expected to be exposed. This issue should be addressed during the design of temporary and permanent erosion control measures for this project.

#### 8.2.3. Reuse of Onsite Materials

According to the results of our laboratory testing the mantle of sand with silt and clay lenses (Unit 1) does not meet the criteria in the Standard Specifications 9-03.14 for gravel, select or common borrow. This material should not be used in the construction of roadway embankments, approach embankments, or around foundations. For estimating purposes, this material is generally observed from the ground surface to about 5 feet bgs.

The native gravel with silt and sand (Unit 2) layer meets the criteria in the Stand Specifications 9-03.14 for common borrow. However, this material contains cobbles and boulders. This material may be used to construct roadway embankments with method B compaction, allowing that the upper 2 feet of embankment is constructed with a 100% passing the 4-inch sieve in accordance with the Standard Specifications. This Material should not be used within the limits

of approach embankments or around foundations. If the cobble and boulder size material is removed, the material may meet the specifications for select borrow. This may be achieved by field screening/sieving the material. Appropriate testing should be completed to reclassify the field screened/sieved material. For estimating purposes, this material is generally observed from about 5 feet bgs to below the bottom of the proposed cut and foundation excavations.

#### 8.3. Bridge Foundation Recommendations

Spread footings are recommended for the US-2/US-97 bridge and equipment crossing under US-2 bridge.

#### 8.3.1. Spread Footings

#### 8.3.1.1. US-2/US-97 Bridge Piers 1 and 2 Abutments

The conditions observed at the planned bridge abutment locations indicate the area is underlain by very dense poorly graded gravel with varying amounts of sand, cobbles and boulders. A chart of recommended bearing resistance versus footing width is presented in Appendix D for Service, Strength, and Extreme Limit loading states. The Service Limit State curve is for footing resistance that corresponds to 1 inch of settlement. The minimum embedment depth of the footings should be at an elevation of about 1074 feet, and should also meet minimum embedment requirements in the BDM for footings.

#### 8.3.1.2. Equipment Crossing Bridge Piers 1 and 2 Abutments

The conditions observed at the planned equipment crossing bridge abutment locations indicate the area is underlain by very dense poorly graded gravel with varying amounts of silt, sand, cobbles and boulders and dense to very dense silty sand. A chart of recommended bearing resistance versus footing width is presented in Appendix D for Service, Strength, and Extreme Limit loading states. The Service Limit State curve is for footing resistance that corresponds to 1 inch of settlement. The minimum embedment depth of the footings should be at an elevation of about 1072 feet, and should also meet minimum embedment requirements in the BDM for footings.

#### 8.3.1.3. Spread Footing Resistance Factors

We recommend the following resistance factors be used for spread footing design when evaluating the different limit states.

Table 1 - Spread Footing Resistance Factors

Limit	Resistance Factor, φ		
State	Bearing	Shear Resistance to Sliding	Passive Pressure Resistance to Sliding
Strength	0.45	0.80	0.50
Service	1.00	1.00	1.00
Extreme	0.9	0.9	0.9

#### 8.3.1.4. Spread Footing Equivalent Spring Constants

Equivalent spring constants for the spread footing foundations should be determined by the method outlined in Section 7.2.4 of FHWA Report No. IP-87-6 titled: Seismic Design and Retrofit for Highway Bridges. The shear modulus and Poisson's ratio of the foundation soil must be estimated to calculate the equivalent spring constant using this method. Based on the results of our analysis, we have developed a range of shear modulus values for the soil unit under these subject spread footings. The most critical spring constant for the structure depends on the rigidity of the superstructure. This is determined by the structural engineer. A range of shear modulus values are presented below, so as to determine which is more critical, a weak or stiff spring.

Table 2 – Shear Modulus versus Foundation Soil Strain

Shear Modulus, G	Strain	Poisson's ratio, μ
523 to 1570 tsf	0.2 to 0.02%	0.35

#### 8.4. RETAINING WALLS

Retaining walls planned for this project include abutment walls for the US-2/US-97 bridge and equipment under crossing bridge. For design of the walls, passive pressure resistance at the foundation toe and active lateral earth pressures should be computed using the soil properties contained in Table 3, in conjunction with the design methodology presented in the WSDOT BDM. The properties in Table 3 are based on the use of select or gravel borrow as backfill for the walls.

Table 3: Lateral Earth Pressure Coefficients and Soil Parameters

Parameter	Value
Backfill Unit Weight (γ)	130 pcf
Backfill Soil Friction Angle (φ <sub>f</sub> )	36°
Active Earth Pressure (K <sub>a</sub> )	0.26
Bearing Soil Friction Angle (φ <sub>f</sub> )	38°
Passive Earth Pressure (K <sub>p</sub> ) - Unfactored	3.85
Seismic Active Earth Pressure (Kae)	0.35
Coefficient of Sliding (tan $\phi_f$ )	0.55
Nominal Bearing Capacity – Service	
Nominal Bearing Capacity – Strength &	See Appendix D
Extreme	

The coefficient of sliding provided in Table 3 presumes that cast-in-place concrete construction will be used. Per the BDM, the lateral earth pressure due to traffic surcharge loading could be calculated using a uniformly distributed load at the ground surface of 250 psf, multiplied by  $K_a$  ( $K_a \times 250$  psf), or 65psf.

These walls should be designed using LRFD methodology. Resistance factors for designing these walls for the Service, Strength and Extreme states are provided in Table 1.

#### 8.5. Approach Slabs

The WSDOT Design Manual, Section 1120.04(6), requires all bridges to have approach slabs unless approval for their deletion has been given. We are recommending that approach slabs be included since construction of the spread footings at the abutments will require an approximate 15 foot excavation with fill replacement. Although significant long-term creep settlement is not expected, the approach slabs will help to limit any settlement that occurs within the fill placed during construction of the spread footings. Long-term creep settlement is not expected due to the granular nature of both the fill and the foundation material.

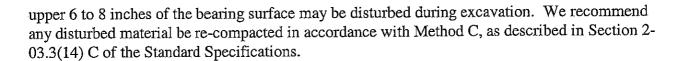
#### 8.6. INFILTRATION/DETENTION PONDS

The North Central Region Materials Laboratory will provide recommendations regarding infiltration rate, impact of infiltration on adjacent facilities, and potential embankment slopes associated with the ponds. The ponds should be designed in accordance with the WSDOT Highway Runoff Manual.

#### 9. CONSTRUCTION CONSIDERATIONS

#### 9.1. FOUNDATION EXCAVATIONS

Footing excavations should be performed with a smooth-edged bucket to limit bearing surface disturbance. As discussed above, we anticipate that the spread footings will bear on very dense poorly graded gravel with varying amounts of sand, cobbles and boulders. In our experience, the



#### 9.2. TEMPORARY SLOPES AND SHORING

Temporary slopes and shoring are the responsibility of the contractor, and the contractor shall determine the appropriate measures to insure that all excavation work is in compliance with local, state and federal safety codes. Washington Administrative Code (WAC) 296-155 contains specific requirements for trenches and temporary slopes. Based on our assessment of the site soils and the presence of a sloping ground surface, it is our opinion that the contractor performing this work may consider the soils to be type C. Type C soils in WAC require 1V:1.5H (vertical:horizontal) slopes for excavations, or the use of protection such as trench boxes or shoring. For planning and cost estimating structure excavations, we recommend that you plan on a 1V:1.5H slope for excavations. It should be noted that, during construction spread footing excavations may require temporary shoring to support the existing lanes of US-2.

#### 9.3. COMPACTING ON-SITE MATERIALS

The upper mantel of sand with silt and clay lenses contains a variable percentage of fines (silt and clay-sized particles passing the U.S. No. 200 sieve) and can be moisture sensitive. When the moisture content of the soil is more than a few percentage points above or below the optimum moisture content it may become difficult or impossible to meet required compaction criteria. During dry weather water may need to be added to meet required compaction criteria. During wet weather it may be impossible to dry soil enough to meet required compaction requirements. Disturbance of near surface soil should be expected if earthwork is completed during wet weather.

#### 10. CLOSURE

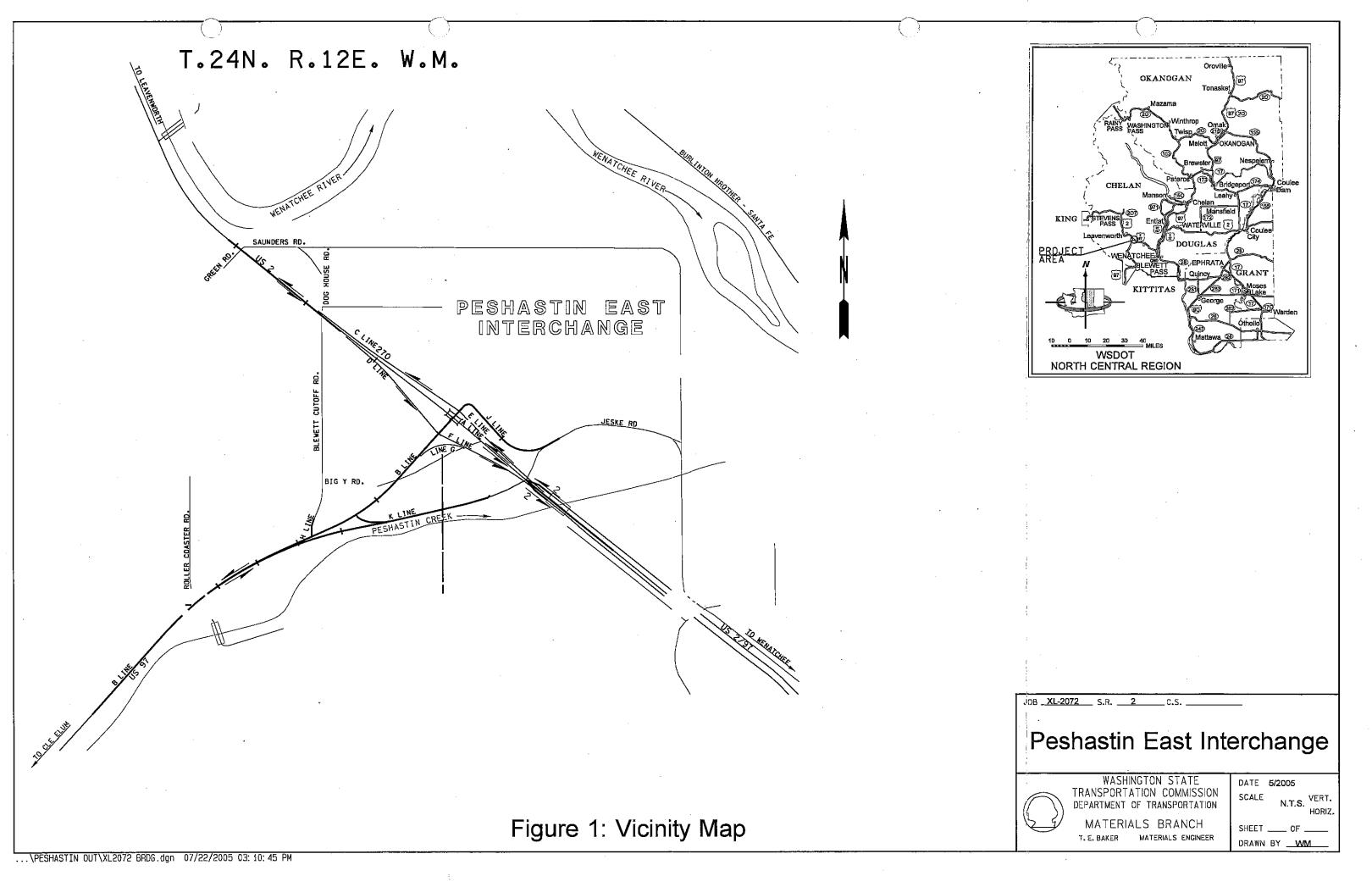
If you have any questions or require further information, please contact Tony Allen at 360.709.5450 or Andrew Fiske at 360.709.5456.

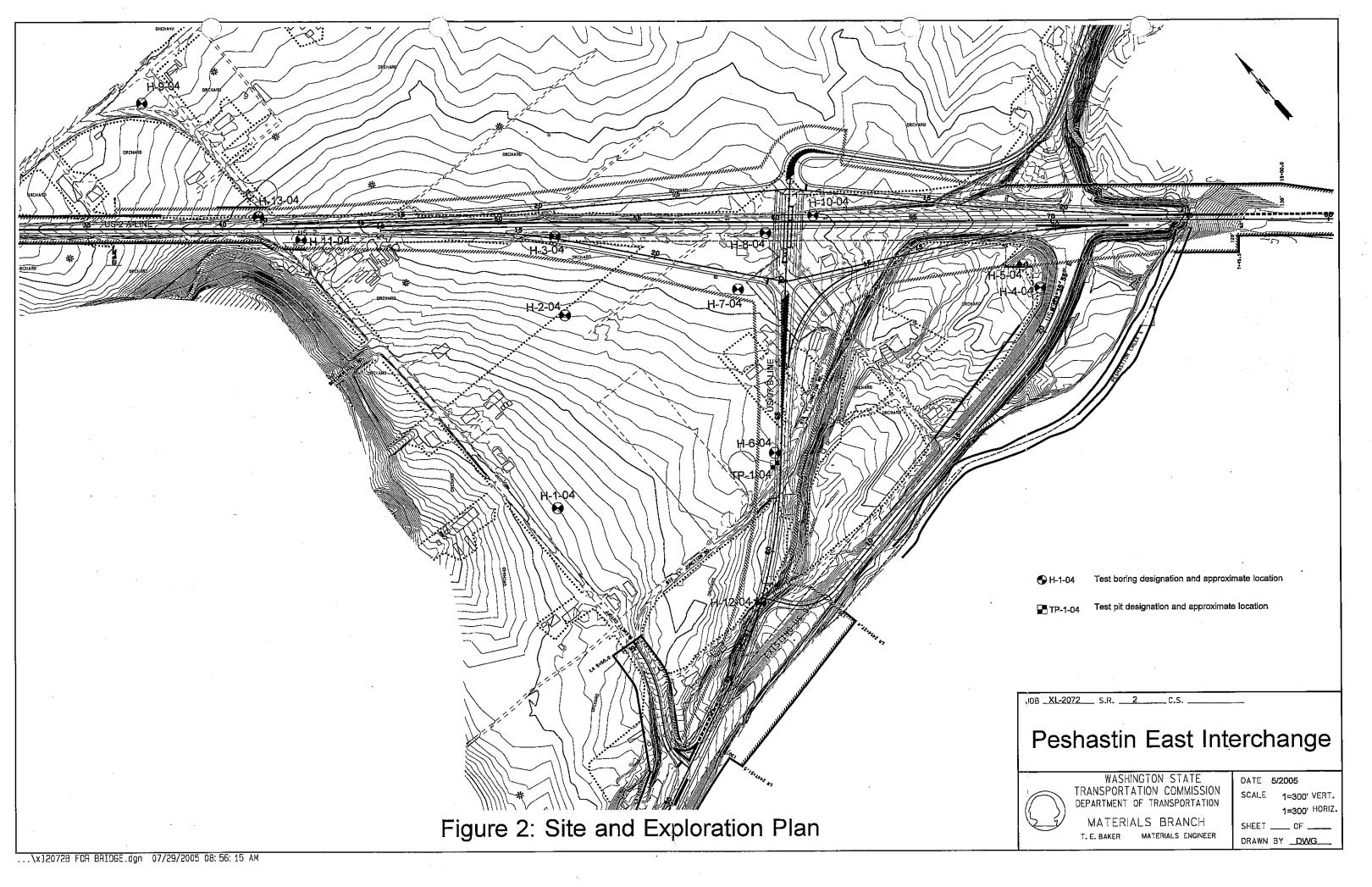
#### 11. REFERENCES

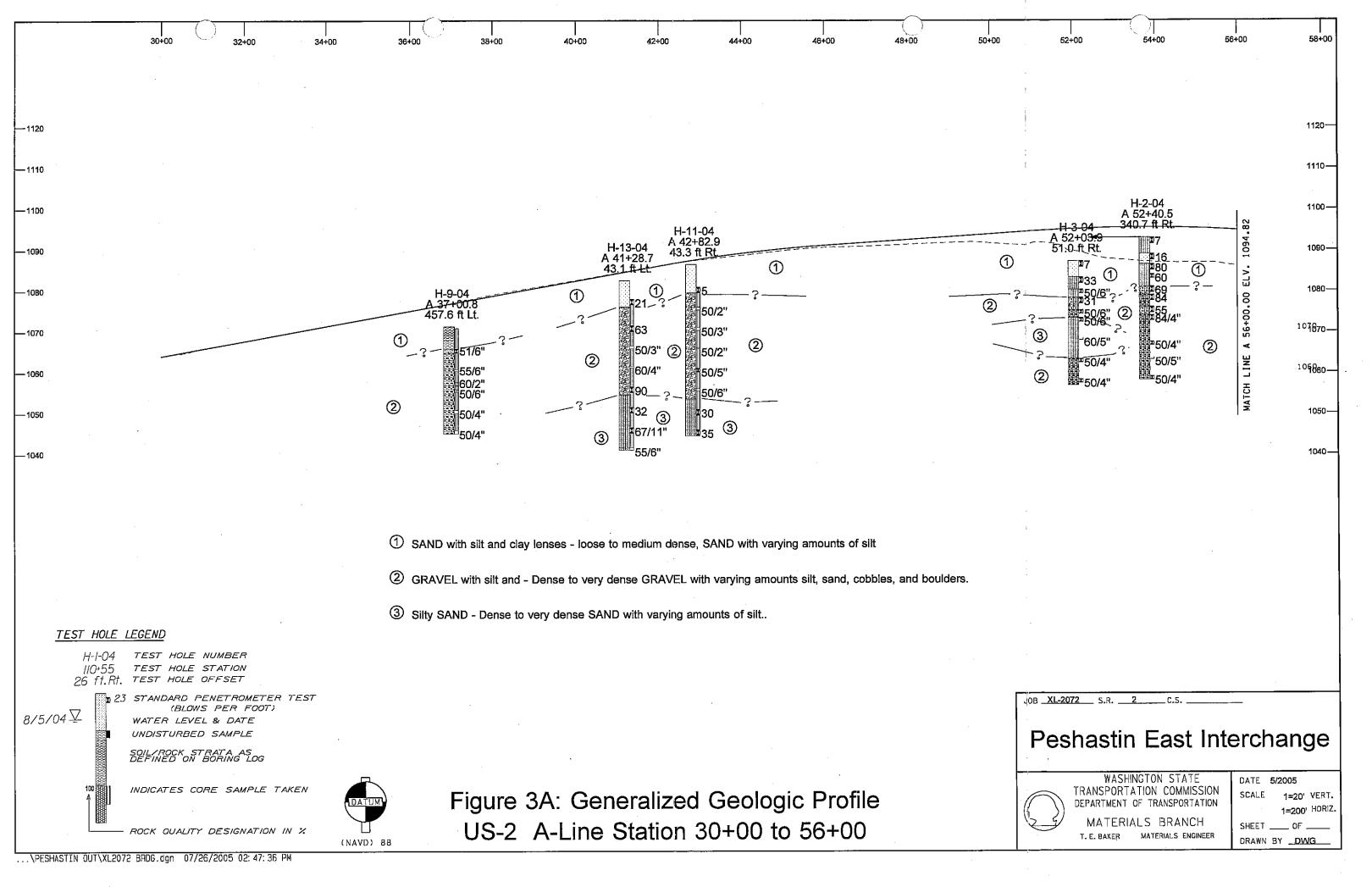
Tabor, R.W. et al. (1987) Geologic Map of the Chelan 30-Minute by 60-Minute Quadrangle, Washington, *Geologic Investigations Series I-1661*, United States Geological Survey, Washington, DC.

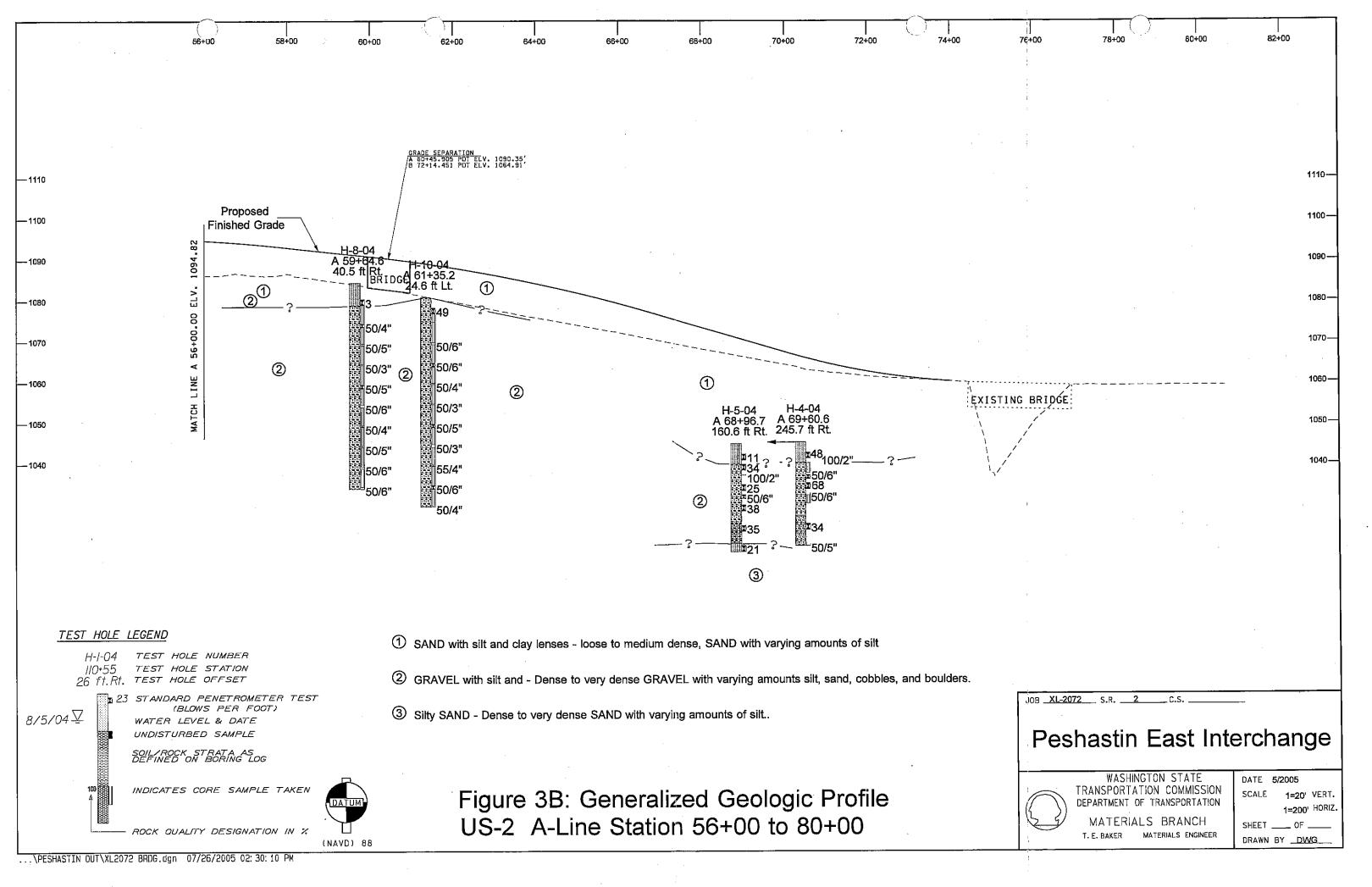
Dragovich, J.D. et. al. (2002) Geologic Map of Washington - Northwest Quadrant, *Geologic Map GM-50*, Washington Division of Geology and Earth Resources.

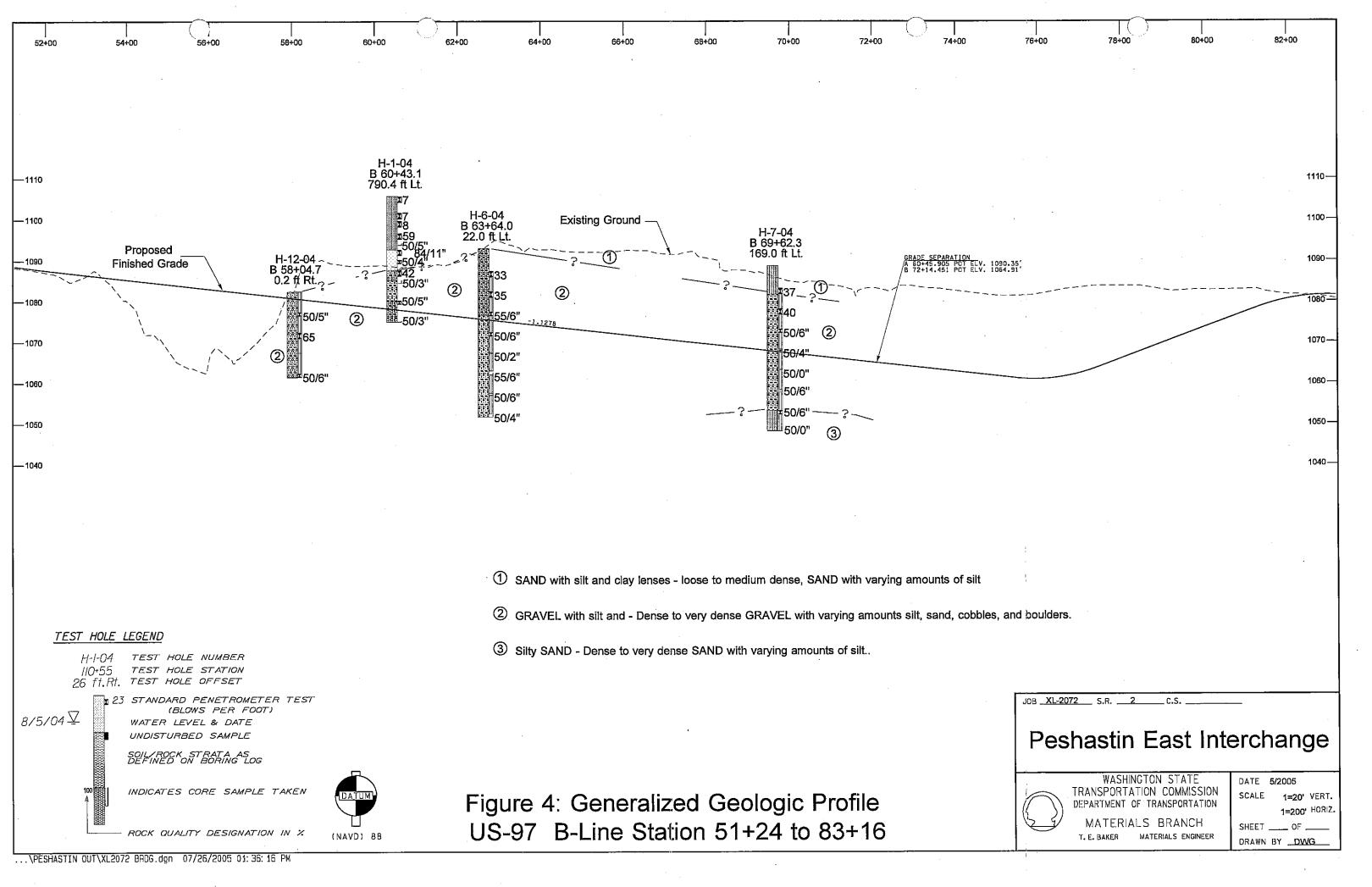
FIGURES



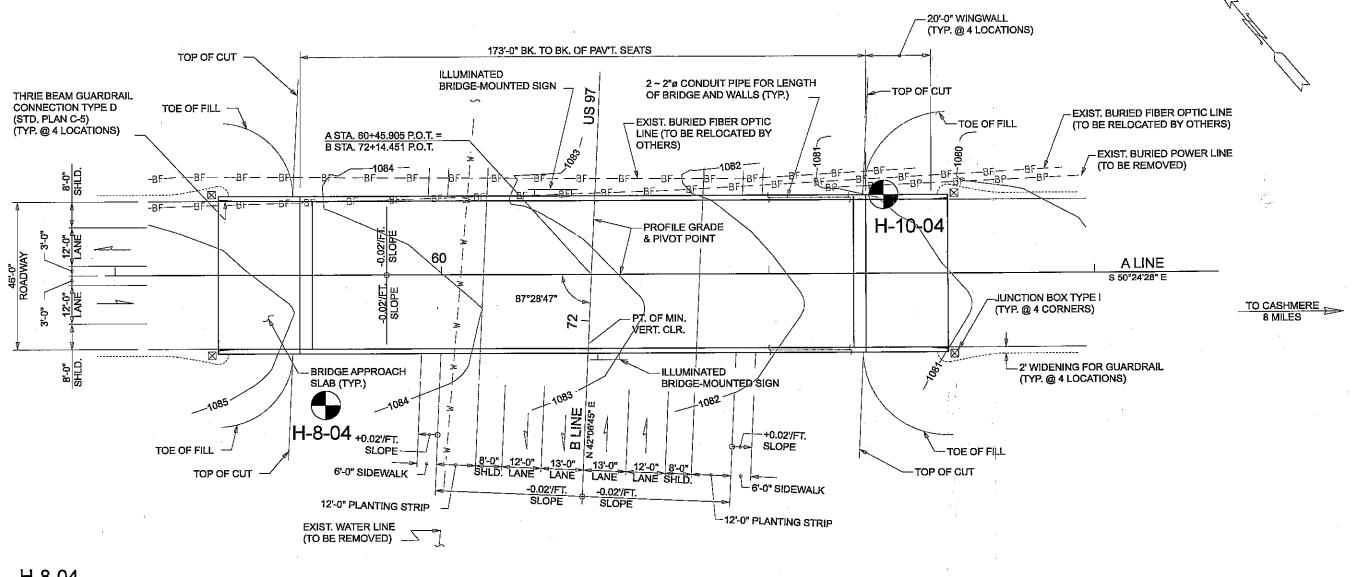








## SEC. 21, T.24N. R.12E. W.M. **CHELAN COUNTY** US 2



H-8-04



Test hole designation and approximate location.

Figure 5:Bridge Site and Exploration Plan

# Peshastin East Interchange US2 Overcrossing



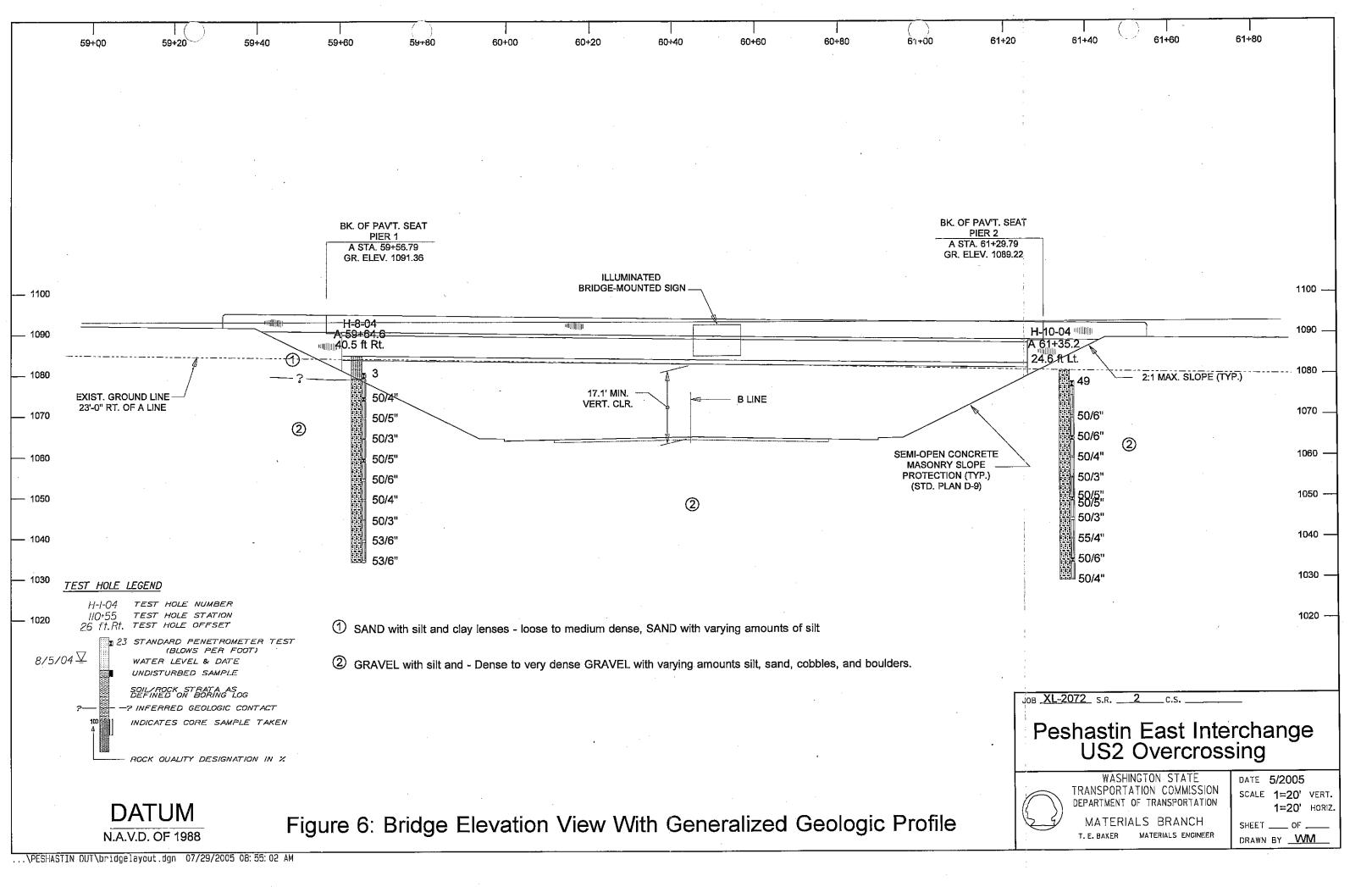
WASHINGTON STATE TRANSPORTATION COMMISSION DEPARTMENT OF TRANSPORTATION

JOB XL-2072 s.r. 2 c.s. \_\_

MATERIALS BRANCH T. E. BAKER MATERIALS ENGINEER DATE 5/2005 SCALE 1=30' VERT. 1=30' HORIZ.

DRAWN BY WM

TO LEAVENWORTH 5 MILES



**APPENDIX A: Boring and Test Pit Logs** 

## Test Boring Legend

Page 1 of 2

	Sampler Symbols
	Standard Penetration Test
	Oversized Penetration Test (Dames & Moore, California)
	Shelby Tube
P	Piston Sample
	Washington Undisturbed
	Vane Shear Test
	Core
	Becker Hammer
	Bag Sample

Well Symbols
Cement Surface Seal
Piezometer Pipe in Granular Bentonite Seal
Piezometer Pipe in Sand
Well Screen in Sand
Granular Bentonite Bottom Seal
Inclinometer Casing in Concrete Bentonite Grout

	_aboratory Testing Codes
ŲU	Unconsolidated Undrained Triaxial
CU	Consolidated Undrained Triaxial
CD	Consolidated Drained Triaxial
UC	Unconfined Compression Test
DS	Direct Shear Test
CN	Consolidation Test
GS	Grain Size Distribution
MC	Moisture Content
SG	Specific Gravity
OR	Organic Content
DN	Density
AL	Atterberg Limits
PT	Point Load Compressive Test
SL	Slake Test
DG	Degradation
LA	LA Abrasion
НТ	Hydrometer Test

Soil Density Modifiers			
Gravel,	Sand & Non-plastic Silt	Elasti	c Silts and Clay
SPT Density		SPT Blows/ft	Consistency
0-4	Very Loose	0-1	Very Soft
5-10	Loose	2-4	Soft
11-24	Medium Dense	5-8	Medium Stiff
25-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		31-60	Hard
		>60	Very Hard

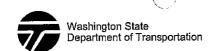
Angularity of Gravel & Cobbles			
Angular	Coarse particles have sharp edges and relatively plane sides with unpolished surfaces.		
Subangular	Coarse grained particles are similar to angular but have rounded edges.		
Subrounded	Coarse grained particles have nearly plane sides but have well rounded corners and edges.		
Rounded	Coarse grained particles have smoothly curved sides and no edges.		

S	oil Moisture Modifiers
Dry	Absence of moisture; dusty, dry to touch
Moist	Damp but no visible water
Wet	Visible free water

	Soil Structure
Stratified	Alternating layers of varying material or color at least 6mm thick; note thickness and inclination.
Laminated	Alternating layers of varying material or color less than 6mm thick; note thickness and inclination.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, somtimes striated.
Blocky	Cohesive soil that can be broken down into smaller angular lumps which resist further breakdown.
Disrupted	Soil structure is broken and mixed. Infers that material has moved substantially - landslide debris.
Homogeneous	Same color and appearance throughout.

HCL Reaction
No visible reaction.
Some reaction with bubbles forming slowly.
Violent reaction with bubbles forming imediately.

Degree of	Vesicularity of Pyroclastic Rocks
Slightly Vesicular	5 to 10 percent of total
. Moderately Vesicular	10 to 25 percent of total
Highly Vesicular	25 to 50 percent of total
Scoriaceous	Greater than 50 percent of total



## **Test Boring Legend**

Page 2 of 2

		1 490 2 01 2
		Grain Size
Fine Grained	< 1mm	Few crystal boundaries/grains are distinguishable in the field or with hand lens.
Medium Grained	1mm to 5mm	Most crystal boundaries/grains are distinguishable with the aid of a hand lens.
Coarse Grained	> 5mm	Most crystal boundaries/grains are distinguishable with the naked eye.

Term	Description	Grade
Fresh	No visible sign of rock material weathering; perhaps slight discoloration in major discontinuity surfaces.	I
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than its fresh condition.	п
Moderately Weathered	Less than half of the rock material is decomposed and/or disintegrated to soil. Fresh or discolored rock is present either as a continuous framework or as core stones.	ш
Highly Weathered	More than half of the rock material is decomposed and/or disintegrated to soil. Fresh or discolored rock is present either as discontinuous framework or as core stone.	īv
Completely Weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.	v
Residual Soil	All rock material is converted to soil. The mass structure and material fabric is destroyed. There is a large change in volume, but the soil has not been significantly transported.	VI

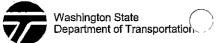
		Relative Rock Strength						
Grade								
R1	Very Weak	Specimen crumbles under sharp blow from point of geological hammer, and can be cut with a pocket knife.	150-3500 psi					
R2	Moderately Weak	Shallow cuts or scrapes can be made in a specimen with a pocket knife.  Geological hammer point indents deeply with firm blow.	3500-7500 psi					
R3	Moderately Strong	Specimen cannot be scraped or cut with a pocket knife, shallow indentation can be made under firm blows from a hammer.	7500-15000 psi					
R4	Strong	Specimen breaks with one firm blow from the hammer end of a geological hammer.	15000-350000 psi					
R5	Very Strong	Specimen requires many blows of a geological hammer to break intact sample.	Greater than 30000 psi					

### Discontinuities

S	pacing				
Very Widely	Greater than 3 m				
Widely	1 m to 3 m				
Moderately	0.3 m to 1 m				
Closely	50 mm to 300 mm				
Very Closely	Less than 50 mm				
R	QD (%)				
	core in pieces > 100mm) th of core run				
Leng	in or core run	]			

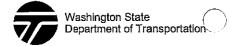
	Condition						
Excellent	Very rough surfaces, no separation, hard discontinuity wall						
Good	Slightly rough surfaces, separation less than 1 mm, hard discontinuity wall.						
Fair	Slightly rough surfaces, separation greater than 1 mm, soft discontinuity wall.						
Poor	Slickensided surfaces, or soft gouge less than 5 mm thick, or open discontinuities 1 to 5 mm.						
Very Poor	Soft gouge greater than 5 mm thick, or open discontinuities greater than 5 mm.						

Fracture Frequency (FF) is the average number of fractures per 300 mm of core. Does not include mechanical breaks caused by drilling or handling.



Department of Transpo	ortation/			Start Card _	R 65802		
Job No. XL-2072	SR <u>2</u>	Elevation 1106	.0 ft (337.1 m)	HOLE No			
Project Peshastin East- Inter	rchange				1 of 2 Fetterly	Lic#_2	2708
Site Address Vic. US. 2 & SR 97			·	Inspector_	Hanning		
Start February 10, 2004	Completion February 11, 20	04 <sub>Well ID#</sub> AHF	997	Equipment_	CME 850 w/ aut	ohammer	
Station B 60+43.1	Offset 790.4 ft Lt.	CasingHW	Т5"	Method _\	Wet Rotary		
Northing 703711.276	Easting 2198531.751	Latitude		Longitude			
County_Chelan	Subsection NE/SW		Section	21 Range	18 EWM Tov	wnship <u>24N</u>	
- S Sts	andard 9	9 0				. 5	

Depth (ft)	Meters (m)	Profile	Pe	tandard netration Blows/ft	40	SPT . Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Inetramont
	-1					3 3 4 (7)	X	D-1		Well-graded SAND with silt and gravel, some organics, loose, brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.0 ft		\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
5—	_		<b>♦</b> ]		 	2 3 4 (7)	X	D-2		Well-graded SAND with silt and gravel, some organics, loose, brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.7 ft	- 	XXXX
	2 		<b>*</b>			2 4 4 (8)	X	D-3	GS MC	SW-SM, M.C.=10% Well-graded SAND with silt and gravel, some organics, loose, brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.5 ft		
- 10 -	<b>—3</b>				>>4	8 30 29 (59)	X	D-4		Well-graded SAND with silt and gravel, trace organics, subrounded, very dense, grayish brown, moist, Stratified, no HCl reaction. Note first contact with gravel/small cobbles at 8 ft. Refusal with hollow stem auger at 10.5 ft changed to HWT casing advancer.  Length Recovered 1.3 ft	- 	
_				.		50/5 (50/5")	X	D-5		No Recovery	-	
15—	<b>-4</b>				>>4	18 34 50/5" (84/11")	X	D-6	GS MC	ML, M.C.=29% Sandy SILT, very dense, brownish gray, moist, Homogeneous, no HCl reaction. Note changed from HWT casing advancer to core barrel at 11.9 ft. Drilling behavior indicates small cobbles. Length Recovered 1.0 ft	† <u> </u>	
-	<b>-</b> 5					24 50/4" (50/4")	X	D-7		No Recovery		
-	-	2000		]   		17 24 18 (42)	Y	D-8	GS MC	GW-GM, M.C.=10% Well-graded GRAVEL with silt and sand, subangular, dense, brownish gray, moist, Stratified, no HCl reaction Length Recovered 1.3 ft	<del>-</del> -	



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Start Card R 65802

HOLE No. <u>H-1-04</u>

Sheet 2 of 2

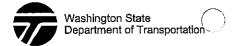
Job No. XL-2072 SR

SR 2

Elevation 1106.0 ft (337.1 m)

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	-	Peshasti		Stan				pe	.o ?		Driller Fetterly	Lic# jaj	
Depth (ft)	Meters (m)	Profile	10_	Peneti Blow	ration	40	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
-	-						26 50/3" (50/3")	X	D-9		Poorly graded GRAVEL with sand, subangular, very dense, dark gray, moist, Homogeneous, no HCl reaction Length Recovered 0.5 ft		
25-	8						28 50/5" (50/11")	X	D-10		Silty GRAVEL with sand, rounded, very dense, gray, moist, Stratified, no HCl reaction. Note bottom of sample very silty, light gray. Note some small cobbles & large gravel recovered in core barrel.	-	
30—	-9		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			50/3"	×	<del>- D-11</del>		Length Recovered 0.8 ft  No Recovery	- - - -	
1	- 10			           			(50/3")				End of test hole boring at 30.7 ft below ground elevation.  This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.  Bailed Hole/No Recharge	- - -	
35-	—11		           		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1								-
- 40—	12 12	•	           										
-	—13		         									-    -	
<u>-</u>					į							.	1



Start Card R 65802 HOLE No. H-2-04

Inspector Hanning

Job No_XL-2072	SR	 Elevation	1093.0 ft (333.1 m)

Sheet 1 of 2 Lic#<u>2708</u> Driller Fetterly

Project Peshastin East- Interchange

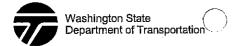
Site Address Vic. US. 2 & SR 97

Equipment CME 850 w/ autohammer Start February 11, 2004 Completion February 12, 2004 Well ID# AHP 998

\_\_\_\_ Casing HWT 6" Method Wet Rotary Station A 52+40.5 Offset 340.7 ft Rt.

Northing 704240,662 Easting 2199004.086 Latitude Longitude

Depth (ft)	-		Standard Penetration Blows/ft _10 20 30 40	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
-	_			5 4 3 (7)	X	D-1	GS MC	SM, M.C. =18% Silty SAND with organics, loose, brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.5 ft.		
5-	—1 -			6 6 10 (16)	X	D-2	GS MC AL	ML, M.C. =17%, PI =8 SILT with sand, trace organics and fine gravel, medium dense, olive brown, moist, Stratified, no HCl reaction. Length Recovered 0.6 ft	-	
-	<b>-</b> 2		>>	24 34 46 (80)	X	D-3		Poorly graded SAND with silt and gravel, very dense, brownish, moist, Stratified, no HCl reaction.  Length Recovered 1.3 ft.	-	A A A A A
10-	-3			28 60 (60)	X	D-4	GS MC	SP-SM, M.C. =9% Poorly graded SAND with silt and gravel, very dense, gray, moist, Homogeneous, no HCl reaction. Note drilling indicates large gravel, possible small cobbles. Length Recovered 1.0 ft.	- 	
-	4	00° C	>>	30 35 34 (69)	X	D-5	GS MC	GW-GM, M.C. =9% Well-graded GRAVEL with silt and sand, subrounded, very dense, gray, moist, Stratified, no HCl reaction. Length Recovered 1.3 ft.	<u> </u>	
- 15— -	- 5		>>	21 43 41 (84)	X	D-6		Well graded GRAVEL with silt and sand, subrounded, very dense, gray, moist, Homogeneous, no HCI reaction. Note blow count from standard penetrometer, material retrieved in oversized sampler.  Length Recovered 1.5 ft.	i .	C   O
_			>>	26 29 26 (55)	X	D-7	GS MC	GW-GM, M.C. =7% Well-graded GRAVEL with silt and sand, subrounded, very dense, gray, moist, Homogeneous, no HCl reaction. Length Recovered 1.3 ft.	  - 	
-	6		>>	16 34	Y	D-8		Sifty GRAVEL with sand, subangular, very dense, gray, moist, Homogeneous, no HCl reaction. Note switched	†    -	



sr \_\_\_\_\_

Job No. XL-2072\_\_\_\_

#### LOG OF TEST BORING

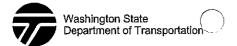
Start Card R 65802

HOLE No. H-2-04

Sheet 2 of 2

Elevation \_1093.0 ft (333.1 m)

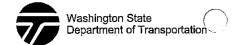
Depth (ft) Meters (m) Profile	Standard Penetration Blows/ft 10 20 30 40	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	· ·
7		50/5" (84/11")				from HWT Casing advancer to Core barrel at 20.5 ft. Length Recovered 1.0 ft.	-	
258		30 50/4" (50/4")	X	D-9		Silty GRAVEL with sand, subrounded, very dense, gray, moist, Homogeneous, no HCI reaction. Note picture taken of core recovery. Note switched from core barrel to HQ casing advancer at 26.4 ft.  Length Recovered 0.4 ft.	- - - -	
		50/5" (50/5")	×	D-10		Silty GRAVEL with sand, subangular, very dense, gray, moist, Homogeneous, no HCI reaction. Note 1.7 ft. boulder 29.9 to 31.6 Length Recovered 0.4 ft.	-	
35-		28 50/4" (50/4")	X	D-11		Silty GRAVEL with sand, subangular, very dense, gray, moist, Homogeneous, no HCl reaction.  Length Recovered 0.4 ft.  End of test hole boring at 34.9 ft below ground elevation.  This is a summary Log of Test Boring. Soil/Rock		
40—						descriptions are derived from visual field identifications and laboratory test data.  Bailed Hole/No Recharge	- - - -	
-13								



$\langle \rangle$	
	Start Card R 65802
1	HOLE No. H-3-04
J.	Sheet 1 of 2

Job No. XL-2072	SR <u>2</u>	Elevation _1087.1 ft (331.3 m)	HOLE No. <u>H-3-04</u> Sheet <u>1</u> of <u>2</u>
Project Peshastin East- Inter	rchange		Driller Fetterly Lic# 2708
Site Address Vic. US. 2 & SR 97		· · · · · · · · · · · · · · · · · · ·	Inspector Hanning
Start February 17, 2004	_ Completion February 19, 2004	Well ID#AHP 999	Equipment CME 850 w/ autohammer
Station A 52+03.9	Offset 51.0 ft Rt.	Casing HWT 6"	Method Wet Rotary
Northing _704487.241	Easting2199160.45	Latitude	Longitude

г		County_	Chelan	Subsection_NE	/SW				Section 21 Range 18EWM Township 2	4N	-
	Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft 10 20 30 40	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	hacteristical
		_			3 3 4 (7)	X	D-1		Sandy SILT with some gravel and organics, loose, brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.0 ft.	-	
	- 5—	1 1 			4 8 25 (33)	X	D-2	GS MC	SM, M.C.=15% Silty SAND with gravel, dense, grayish brown, moist, Stratified, no HCI reaction. Length Recovered 1.0 ft.		
	-	-2 -			23 50/6" (50/6")	X	D-3	GS MC	SP-SM, M.C.=10% Poorly graded SAND with silt and gravel, very dense, olive brown, moist, Stratified, no HCl reaction. Note recovery from 2" penetrometer, blow count from standard. Length Recovered 0.7 ft.	-	X X X X X
5/05,6:29:15 A7	10	-3	0.00.00		7 9 22 (31)	X	D-4	GS MC	GW-GM, M.C.=9% Well-graded GRAVEL with silt and sand, subrounded, dense, olive gray, moist, Homogeneous, no HCl reaction. Length Recovered 0.7 ft.		
E.GPJ SOIL.GDT 7/2	-	<u>-</u> :—4			12 50/6" (50/6")	X	D-5		Silty GRAVEL with sand, subangular, very dense, olive gray, moist, Homogeneous, no HCl reaction. Note drilling indicates small cobbles and large gravel.  Length Recovered 0.7 ft.		
SOIL XL-2072 SR 2 PESHASTIN EAST INTERCHANGE,GPJ SOIL.GDT 7/25/05,6:29:15 A7	- 15	-			22 50/6" (50/6")	X	D-6	GS MC	SP-SM, M.C.=9% Poorly graded SAND with silt and gravel, very dense, gray, moist, Homogeneous, no HCl reaction. Note drilling indicates large gravel/small cobbles. Length Recovered 0.5 ft		
72 SR 2 PESHASTI	-	<u>-5</u>								—  - 	
SOIL XL-20;	- 20—	6		>>•	60/5" (60/5")	X	D-7		No Recovery	- -	



()

Start Card R 65802

HOLE No. H-3-04

Sheet 2 of 2

Job No. XL-2072 SR 2

Elevation \_\_1087.1 ft (331.3 m)

Officer 5 of 5

	Project	Peshas	stin Eas	st- Int	ercha	nge								Driller Fetterly	Lic#	2708
Depth (ft)	Meters (m)	Profile	10	Pe	Standar enetrat Blows/	ion ft	-0	SPT Blows/6" (N)	Sample Type	Sample No.	(Tube No.)	Lab	Tests	Description of Material	Groundwater	Instrument
25-								35 50/4" (50/4") 43 50/4" (50/4")	X	D-				Silty GRAVEL with sand, angular, very dense, brownish gray, moist, Homogeneous, no HCl reaction. Note drilling indicates large gravel/small cobbles.  Length Recovered 0.5 ft  Silty GRAVEL with sand, angular, very dense, gray, moist, Homogeneous, no HCl reaction.  Length Recovered 0.9 ft.		
SOIL.GDT 7/25/05,6:29:15 A7														End of test hole boring at 30.5 ft below ground elevation.  This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.  Bailed hole/No Recharge		
SOIL XL-2072 SR.2 PESHASTIN EAST INTERCHANGE.GPJ SOIL.GDT 7/25/05,6:	-12					1 1 1 1 1 1 1 1 1 1	                         									
SOIL XL-2072	_				1         	     	 								-	



Project Peshastin East- Interchange

#### LOG OF TEST BORING

Start Card R 65850

Job No. XL-2072	SR	2	Elevation	_1045.3 ft (	(318.6 m)

HOLE No. H-4-04 Sheet 1 of 2

Driller	Jae	bbuL

Lic# 2454

Site Address	SR 97 & SR 2	

Inspector Dave Nelson

Equipment CME 850 w/ autohammer Start July 7, 2004 Completion July 7, 2004 AHN-664 Well ID#.

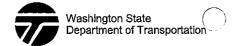
Station A 69+60.6

Offset 245.7 ft Rt. Casing\_

6" x 5.0 & 4" x 25.0

Method Wet Rotary

	_	703217.5 Chelan	561			00390.14 V 1/4 of S			tude	LongitudeSection 21 Range 18 EWM Township 2	4	_
Deoth (#)		Profile	F	Standard Penetration Blows/ft	40	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab	Description of Material	Groundwater	Instrument
	1 1 		10 :	20 30	40   	5 20 28 (48) 100/2" (100/2")	X	D-1 D-2 C-3	GS MC	SP, M.C. = 11% Poorly graded SAND with gravel, dense, brown, dry, Homogeneous, HCl not tested. Length Recovered 1.0 ft  No Recovery  Poorly graded GRAVEL with silt, sand, cobbles and boulders, very dense, brown, dry, Homogeneous, HCl not		
25/05,6:29:16 A7	03					28 50/6" (50/6") 40 34 34 (68)	II X	D-4		tested. Core Length Recovered 2.5 ft  Poorly graded GRAVEL with silt, sand, cobbles and boulders, very dense, brown, dry, Homogeneous, HCL not tested. Length Recovered 0.5 ft  No Recovery	- - - -	
ASTIN EAST INTERCHANGE.GPJ SOIL.GDT 7/25/05,6:29:16 A7	5		             		•	50/6" (50/6")		D-6 C-7		Poorly graded GRAVEL with silt, sand, cobbles and boulders, very dense, grey, dry, Homogeneous, HCl not tested. Length Recovered 0.2 ft Poorly graded GRAVEL with silt, sand, cobbles and boulders, very dense, gray, dry, Homogeneous, HCl not tested. Core Length Recovered 1.7 ft	- - - - -	
SOIL XL-2072 SR 2 PESHASTIN EAST INTER	-6	0.000					į					



Job No. XL-2072

### LOG OF TEST BORING

Start Card R 65850

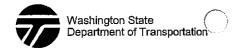
HOLE No. H-4-04

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\_\_\_\_ SR 2 \_\_\_ Elevation 1045.3 ft (318.6 m)

Sheet 2 of 2

Depth (ft)	Meters (m)	Profile	10	Standa Penetra Blows 20	ation	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
-	7					15 18 16 (34)	X	D-8	GS MC AL	GW, M.C. = 14%, LL = 25 Well graded GRAVEL with sand, dense, brown, moist, Homogeneous, HCl not tested. Length Recovered 0.7 ft		
25-	_	0,0	<u> </u>	İ	<u> </u>	50/5"	X	D-9		No Recovery	-	
-										End of test hole boring at 25.4 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.  Bailed drill water to 8.0 ft, 30 minutes later, test hole was	- - -	
-				   						dry	<u> </u>	
30-	-			   							-	
-	-		   	   							-	
-	1		İ	 							-	
-	<u></u> —10				1 I 1 I						-	
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40⊷	-12											
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45-												



Job No. XL-2072

SOIL XL-2072 SR 2 PESHASTIN EAST INTERCHANGE.GPJ SOIL.GDT 7/25/05,6:29:18 A7

#### LOG OF TEST BORING

Start Card R 65850

	HOLE No. H-5-04
Elevation1044.8 ft (318.5 m)	
	Sheet 1 of _

Project Peshastin East- Interchange

Lic#<u>245</u>4 Driller Joe Judd

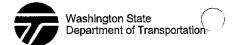
Inspector Dave Nelson Site Address SR 97 & SR 2

Equipment CME 850 w/ autohammer Completion July 8, 2004 Start July 8, 2004 AHN-665 Well ID#

Offset 160.6 ft Rt. Station A 68+96.7 6" x 5.0 & 4" x 25.0 Method Wet Rotary Casing

Easting 2200395.089 Northing 703323.929 Latitude Longitude

	County	Chelan	Subs	ection_SW	/ 1/4 of S	E 1.	/4		Section 21 Range 18 EWM Township 2	4	-
Depth (ft)	Meters (m)	Profile	Standard Penetratior Blows/ft 10 20 30	1 40	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	1		*		3 5 6 (11)	X	D-1	GS MC AL	SM, M.C. = 16%, PI = NP Silty SAND with gravel, medium dense, brown, moist, Homogeneous, HCl not tested. Length Recovered 1.0 ft	-	
5-					9 14 20 (34)	X	D-2		Poorly graded GRAVEL with cobbles and boulders, subrounded, dense, brown, moist, Homogeneous, HCl not tested. Length Recovered 0.6 ft	  - 	
	-			>> <b>(</b>	100/2 (100/2")	×	D-3		Poorly graded GRAVEL with cobbles and boulders, subrounded, very dense, bluish grey, dry, Homogeneous, HCl not tested. Length Recovered 0.1 ft	- -	
10-	-3				10 12 13 (25)	X	D-4	GS MC AL	GP, M.C. = 20%, PI = 4 Poorly graded GRAVEL with sand, cobbles and boulders, very dense, reddish brown, moist, Homogeneous, HCl not tested. Length Recovered 0.8 ft	  -  -  -	
	4 -				20 50/6" (50/6")	X	D-5		Poorly graded GRAVEL with silt, sand, cobbles and boulders, very dense, brown, moist, Homogeneous, HCI not tested. Length Recovered 0.6 ft		
15-				<b>*</b>	16 18 20 (38)	X	D-6	GS MC	GP-GM, M.C. = 12% Poorly graded GRAVEL with silt, sand and cobbles, dense, bluish grey, moist, Homogeneous, HCl not tested. Length Recovered 1.0 ft	  -  -  -	
	<u></u>									  -	



Job No. XL-2072

## LOG OF TEST BORING

Elevation 1044.8 ft (318.5 m)

Start Card R 65850

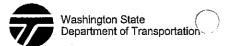
HOLE No. H-5-04

Sheet 2 of 2

SR

oneet \_\_\_ or \_\_\_

D-7 GS GM, M.C. = 13% Silty GRAVEL with sand, dense, bluish grey, moist, Homogeneous, HCl not tested. Length Recovered 1.0 ft  Silty SAND with gravel, medium dense, bluish grey, moist, Homogeneous, HCl not tested. Length Recovered 1.0 ft  Silty SAND with gravel, medium dense, bluish grey, moist, Homogeneous, HCl not tested. Length Recovered 1.0 ft  End of test hole boring at 26.5 ft below ground elevation. This is a summary Log of Test Boring. Soli/Rock descriptions are derived from visual field identifications and laboratory test data.  Balled drilf water to 8.0 ft, 30 minutes later, test hole was dry.			tin East- Inte				0			Driller Joe Judd L		2454
D-7 GS MC CRAVEL with sand, dense, bluish grey, moist, Homogeneous, HCI not tested. Length Recovered 1.0 ft  8 10 11 12 12 13 13 14 14 14 14 14 14 14 14 14 14 14 14 14	Depth (ff) Meters (m)	Profile	Per Bl	netration lows/ft	40	Blows/6"	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
B 10 11 11 11 11 11 11 11 11 11 11 11 11	7					12 23	X	D-7		Silty GRAVEL with sand, dense, bluish grey, moist, Homogeneous, HCl not tested.		
This is a summary Log of Test Boring. Soli/Rock descriptions are developed from visual field identifications and leboratory test data.  Bailed drill water to 8.0 ft, 30 minutes later, test hole was dry.  ———————————————————————————————————	25—		1	/   		10 11	X	D-8		moist, Homogeneous, HCl not tested.	- - - -	
30————————————————————————————————————	-			 	         					This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications		
351112 40	30-									Bailed drill water to 8.0 ft, 30 minutes later, test hole was dry.	<u>-</u> -	-
	_ _ 35										- - -	
40-	11				:           						- - -	-
					 						- - -	
	40			1								
	13										_	



Start Card <u>S 23725</u>

			HOLE No. H-6-04
Job No. XL-2072	sr <u>2</u>	Elevation 1093.3 ft (333.2 m)	
			Sheet1_ of

Project Peshastin East- Interchange

Driller Fetterly

Lic# 2708

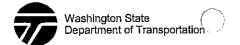
Site Address Vic of SR2 & Big Y Rd..

Inspector Hanning

Start October 26, 2004 Completion October 26, 2004 Well ID# NA Equipment CME 850 w/ autohammer

 Station
 B 63+64.0
 Offset
 22.0 ft Lt.
 Casing
 3.5"
 Method
 Wet Rotary

-	nty chelan	Standard		e l	ń C		Section 21 Range 18 EWM Township 2	Ι. Ι	يدا
Depth (ft)	Profile	Penetration Blows/ft 10 20 30 40	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab	Description of Material	Groundwater	Instrument
5—			9 16 17 (33)		D-1 C-2		Silty GRAVEL with sand, subrounded, dense, gray, moist, Homogeneous, no HCl reaction. Length Recovered 0.8 ft.  Silty GRAVEL with sand, subrounded, dense, gray, moist, Homogeneous, no HCl reaction. Core Length Recovered 2.0 ft,		
103	11 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1		12 18 17 (35)	X	D-3 C-4		Silty GRAVEL with sand, subrounded, dense, gray, moist, Homogeneous, HCl not tested. Length Recovered 0.8 ft.  Silty GRAVEL with sand, subrounded, dense, gray, moist, Homogeneous, no HCl reaction. Core Length Recovered 2.0 ft.		
15—			17 55/6" (55/6")		D-5 C-6		Silty GRAVEL with sand, subrounded, very dense, gray, moist, Homogeneous, HCl not tested.  Length Recovered 0.5 ft.  Poorly graded GRAVEL with cobbles, very dense, gray,moist, Homogeneous, HCl not tested.  Core Length Recovered 1.5 ft		

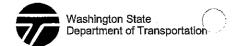


Start Card S 23725

HOLE No. H-6-04

Elevation \_1093.3 ft (333.2 m) Job No. XL-2072 Sheet 2 of \_\_ Project Peshastin East- Interchange Driller Fetterly Lic# 2708

Depth (ft) Meters (m)	Profile 10	Standard Penetration Blows/ft 20 30 40	SPT Blows/6" - (N)	Sample Type Sample No.	(Tube No.)	Lab Tests	Description of Material	Groundwater	
7			34 50/6" (50/6")	D-1			Poorly graded GRAVEL with sand, subrounded, very dense, gray, moist, Homogeneous, HCl not tested. Length Recovered 0.5 ft. Poorly graded GRAVEL with cobbles, very dense, gray,moist, Homogeneous, HCl not tested. Core Length Recovered 1.5 ft	- - - -	_
25			\$0/2" (50/2")	D.( C-1	- 1		No Recovery Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 2.0 ft	- - -	_
-9 30- -10			55/6" (55/6")	D-1 C-1			Poorly graded GRAVEL with sand, subrounded, very dense, gray, moist, Homogeneous, HCl not tested. Length Recovered 0.4 ft. Poorly graded GRAVEL with cobbles, very dense, gray,moist, Homogeneous, HCl not tested. Core length recovered 2.0 ft		
35—			50/6" (50/6")	D-1	- 1		Poorly graded GRAVEL with sand, and some silt, subrounded, very dense, gray, moist, Homogeneous, HCI not tested.  Length Recovered 0.4 ft. Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCI not tested.  Core Length Recovered 2.0 ft	- - - -	-
40			28 50/4" (50/4")	D-1	5		Poorly graded GRAVEL with sand, subrounded, very dense, gray, moist, Homogeneous, HCl not tested.  Length Recovered 0.4 ft.  End of test hole boring at 41.3 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications		-



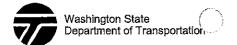
Start Card <u>R 65925</u>

J <sub>ob No.</sub> XL-2072 SR _ 2	Elevation1088.9 ft (331.9 m)	HOLE No. H-7-04	
JBB NO_XE 20.2	Elevation — 1999 in [69 in im]	Sheet 1 of 2	
Project_Peshastin East- Interchange	<u>.</u> .	Driller <u>Hanning</u>	Lic# <u>2196</u>
Site Address_Vic SR2 & big Y Rd.		Inspector_Fetterly/Hanning	

 Start
 October 12, 2004
 Completion
 October 13, 2004
 Well ID#
 AHN 710
 Equipment
 CME 850 w/ autohammer

 Station
 B 69+62.3
 Offset
 169.0 ft Lt.
 Casing
 5"
 Method
 Wet Rotary

ļ	Depth (ft)	Meters (m)	Profile	Stand Penetra Blows	ation	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
SOIL XI-2072 SR 2 PESHASTIN EAST INTERCHANGE GPJ SOIL GDT 7/25/05,6:29:21 A7	5—				◆	6 8 29 (37)		D-1 C-2 D-3 C-4	GS MC	SM, M.C. = 14% Silty SAND with gravel, subrounded, dense, gray, moist, Stratified, HCl not tested Length Recovered 1.0 ft. Poorly graded GRAVEL, dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 2.0 ft  Poorly graded GRAVEL with sand, subrounded, dense, gray, moist, Homogeneous, HCl not tested. Length Recovered 0.8 ft  Poorly graded GRAVEL with sand and cobbles, dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 0.8 ft  Poorly graded GRAVEL with sand, subrounded, very dense, gray, moist, Homogeneous, HCl not tested. Length Recovered 0.8 ft  Poorly graded GRAVEL with sand and cobbles, dense, gray, moist, Homogeneous, HCl not tested. Length Recovered 9.8 ft  Poorly graded GRAVEL with sand and cobbles, dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 2.0 ft		



Job No. XL-2072

## LOG OF TEST BORING

Start Card <u>R 65925</u>

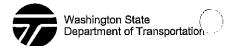
HOLE No. H-7-04

Sheet 2 of 2

SR \_\_2

Elevation 1088.9 ft (331.9 m)

10 20 30 40  50/4* C-6  50/4* D-7 C-6  50/4* D-7 C-7  25  D-8 C-8 C-9 D-8 C-9 D-9 D-9 C-10  D-9 D-1 C-10  50/8* D-1 D-1 D-1 C-10  50/8* D-1 D-1 D-1 C-10  50/8* D-1 D-1 C-10  50/8* D-1 D-1 D-1 C-10  50/8* D-1 D-1 D-1 C-10  50/8* D-1 D-1 D-1 C-10  50/8* D-1 D-1 D-1 C-10  50/8* D-1 D-1 D-1 C-10  50/8* D-1 D-1 D-1 C-10  50/8* D-1 D-1 D-1 C-10  50/8* D-1 D-1 D-1 C-10 D-1 D-1 D-1 C-10 D-1 D-1 D-1 D-1 D-1 D-1 D-1 D-1 D-1 D-1	Depth (ft)	Meters (m)	Profile	40	Stand Peneti Blow	ration vs/ft	40	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab	Tests	Description of Material	Groundwater	lustrument
D-9 (50/0")    D-9 (C-10   D-9		-7			20		40		Ŭ				dense, gray, moist, Homogeneous, HCl not tested. Length Recovered 0.3 ft Poorly graded GRAVEL with cobbles and boulders, dense, gray, moist, Homogeneous, HCl not tested.		
Poorly graded GRAVEL with sand, cobbles and boulders, subrounded, very dense, gray, moist, Homogeneous, HCl not tested. Length Recovered 0.3 ft Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 1.5 ft	25—	8											Poorly graded GRAVEL with cobbles and boulders, very dense, gray, moist, Homogeneous, HCl not tested.	- - - -	
32 50/6" (50/6")  D-13 GS MC Poorly graded SAND with silt, gravel, and cobbles, subrounded, very dense, gray, moist, Homogeneous, HCl not tested. Length Recovered 0.8 ft Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 2.0 ft	30	9 							X				subrounded, very dense, gray, moist, Homogeneous, HCl not tested. Length Recovered 0.3 ft Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested.	-	
	35— - -	11 11						50/6"	X				Poorly graded SAND with silt, gravel, and cobbles, subrounded, very dense, gray, moist, Homogeneous, HCl not tested.  Length Recovered 0.8 ft Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested.	- - - - - -	
No Recovery    50/0"   D-15	40-									D-15			End of test hole boring at 40.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications		



Elevation \_\_1084.4 ft (330.5 m)

Start Card S 22660

HOLE No. H-8-04	

Sheet \_\_1\_\_ of \_\_3\_\_

Driller Fetterly

Project\_Peshastin East- Interchange

2

SR

Lic#\_2708

Site Address Vic. SR2 & Big Y Rd.

Inspector\_Hanning

Start October 13, 2004 Completion October 14, 2004 Well ID# AHN 711

\_\_ Casing\_

Latitude

Equipment CME 850 w/ autohammer

Station A 59+64.6

Job No. XL-2072

Offset 40.5 ft Rt.

Method Wet Rotary

Northing 704010.487

Easting 2199753.4

Longitude

Depth (ft)	Meters (m)	Profile	10	Standa Penetra Blows	ation	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrumont
5	1 		•			1 1 2 (3)		D-1 C-2	GS MC	SM, M.C. = 17% Silty SAND with gravel, loose, brown, moist, Homogeneous, HCl not tested, Drilling behavior indicates large gravel. \Length Recovered 0.5 ft Poorly graded GRAVEL with cobbles and boulders, very dense, dark gray, moist, Homogeneous, HCl not tested. Core Length Recovered 2.0 ft Boulders, 5.5 to 8.3 ft.		
10-	-3					33 50/4" (50/4")		D-3 C-4		Poorly graded GRAVEL with sand, cobbles and boulders, subrounded, very dense, dark gray, moist, Homogeneous, HCI not tested. Length Recovered 0.4 ft Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCI not tested. Core Length Recovered 0.4 ft		
- 15— -	-5					50/5" (50/5")		D-5 C-6		Poorly graded GRAVEL with sand and cobbles, subrounded, very dense, dark gray, moist, Homogeneous, HCl not tested. Length Recovered 0.3 ft Poorly graded GRAVEL with cobbles, very dense, dark gray, moist, Homogeneous, HCl not tested. Core Length Recovered 1.5 ft	1 1	



Start Card S 22660

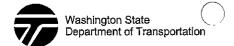
HOLE No. H-8-04

Sheet 2 of 3

Job No. XL-2072

Elevation \_1084.4 ft (330.5 m)

	Peshastin Eas	ı- mierci	itango							Driller Fetterly	Lic#_2	<u> </u>
Depth (ff) Meters (m)	Profile 10	Stand Peneti Blow 20	ration	40	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab	Tests	Description of Material	Groundwater	
7	3.3				50/3" (50/3")	Ĭ	D-7 C-8			No Recovery Poorly graded GRAVEL with cobbles, very dense, dark gray, moist, Homogeneous, HCl not tested. Core Length Recovered 2.0 ft	-	
25—				•	17 50/5" (50/5")	Ĭ	D-9 C-10			Silty GRAVEL with sand and cobbles, subrounded, very dense, dark gray, moist, Homogeneous, HCl not tested. Length Recovered 0.5 ft Poorly graded GRAVEL with cobbles, very dense, dark gray, moist, Homogeneous, HCl not tested. Core Length Recovered 1.5 ft	-	
9 30					50/6" (50/6")		D-11 C-12			Poorly graded GRAVEL, with cobbles and some silt, subrounded, very dense, dark gray, moist, Homogeneous, HCl not tested. Length Recovered 0.4 ft Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 2.0 ft		
- - 					50/4" (50/4")	)   	D-13 C-14			No Recovery Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 1.5 ft		
-12 40- 					50/3" (50/3")		D-15 C-16			No Recovery Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 2.0 ft		



Start Card S 22660

HOLE No. H-8-04

Job No. XL-2072 SR 2

\_\_\_\_\_ Elevation \_\_\_\_\_1084.4 ft (330.5 m)

Sheet 3 of 3

ı	Project	Peshasti	n ⊑ast-	mierci	nange		<u></u>	Т	I	_		Driffer_ <u>Fetterly</u>	Lic#_2	<u> </u>
Depth (ft)	Meters (m)	Profile	10		dard tration ws/ft 30	40	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab	Tests	Description of Material	Groundwater	-
1	—14 -	3:3	1	1	           		53/6" (53/6")	Ĭ	D-17 C-18			Poorly graded GRAVEL, angular, very dense, dark gray, moist, Homogeneous, HCl not tested. Length Recovered 0.3 ft Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 1.5 ft		
50-	—15 -		           		           	>>4	53/6" (53/6")	Ų	D-19			Silty GRAVEL with sand, angular, very dense, gray, \moist, Homogeneous, HCl not tested. \Length Recovered 0.3 ft	/  -  -  -	
-	—16			 		         						End of test hole boring at 50.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.	- -	
55—	—17											Bailed Hole/No Recharge		
60-	- —18 -				         									
-	—19													
65-	—20		         										-	
-	- 21		         							!				



Start Card R 65942 HOLE No. H-9-04 Elevation 1071.3 ft (326.5 m) Job No. XL-2072 Sheet 1 of 2 Project Peshastin East- Interchange Driller Fetterly Lic# 2708 Site Address Vic. of SR2 & Blewett Cutoff Rd. Inspector Hanning Equipment\_CME 850 w/ autohammer \_Well ID#\_\_AHN 709 Start October 2, 2004 Completion October 2, 2004 Method Wet Rotary Station A 37+00.8 Offset 457.6 ft Lt. \_ Casing\_\_\_3.5" Easting 2198314.942 Northing 705822.705 Latitude Longitude

Depth (ft)	Meters (m)	Profile	10	Pene	ndard tration ws/ft 30	40	SF Blow (N	/s/6"	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater
-	-1									C-1	GS MC AL	CL, M.C. = 20%, PI = 8 Lean CLAY, with some sand, stiff, brown moist, Homogeneous, No HCI reaction. Length Recovered 2.5 ft	
5—-	2					   >>           	4( 51/ (51/	6"		D-2 C-3	GS MC AL	SC-SM, M.C. = 19%, PI = 5 GM, M.C. = 9% Silty GRAVEL with sand, subrounded, very dense, gray, moist, Stratified, HCl not tested, Note top .5 ft silty clayey sand. Length Recovered 1.0 ft Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homoegeneous, HCl not tested. Core Length Recovered 1.0 ft	
10	3		; ; ; ; ;			         	55/ (55/		Ň	D-4 C-5		No Recovery Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 1.5 ft	
15—	4					>>	60/		¥	D-6 C-7		No Recovery Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 1.0 ft	
-	5		         				\$50/ (50/		X	D-8 C-9		Poorly graded GRAVEL with sand, and some silt, subrounded, very dense, gray, moist, Homogeneous, HCl not tested. Length Recovered 0.3 ft No Recovery	



Start Card R 65942

HOLE No. H-9-04

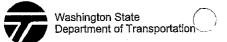
Sheet 2 of 2

Job No. XL-2072

SR

Elevation 1071.3 ft (326.5 m)

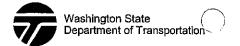
Depth (ft) Meters (m) Profile	Standard Penetration Blows/ft 10 20 30 40	Sample Type Sample No. (Tube No.)	.c. 왕 Description of Material	Groundwater	
		30 50/4" (50/4") C-11	Poorly graded SAND with gravel, very dense, gray, moist, Homogeneous, HCl not tested. Length Recovered 0.2 ft Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 2.0 ft	000000000000000000000000000000000000000	
25— 		16 50/4" (50/4")	Poorly graded GRAVEL with sand, and some silt, subrounded, very dense, gray, moist, Homogeneous, HCI reaction. not tested. Length Recovered 0.3 ft  End of test hole boring at 26.3 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.  Bailed Hole/No Recharge		



Start Card S 23726

Joh No.	XL-2072	SR2	!	Elevation	1080.9 ft (329	.5 m)	ŀ	HOLE No	H-10-04	_	
	Peshastin East- Interd			_levadon _	•			_	1 of Fetterly		ic# <u>270</u> 8
Site Address_	Near Jct SR 2 & SR 9	7						Inspector_	Nebgen		
Start <u>(</u>	October 18, 2004	Completion C	October 19, 2004	Well ID#_		<del></del>	E	Equipment_	CME 850 w/	autohamm	er
Station_	A 61+35.2	Offset_	24.6 ft Lt.	Casing	4"x51			Method_	Wet Rotary		
Northing _	703951.922	Easting_	2199926.321	Latitude		<u></u>		Longitude_	· <del></del>		<del></del>
County_	Chelan	Subsection_	NW/SE			Section	21	_ Range_	18 EWM	Township_2	4

Depth (ft) Meters (m)	Profile	Standard Penetration Blows/ft 20 30 40	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	
5			22 37 12 (49)	X	D-1 C-2		No Recovery  Poorly graded GRAVEL, with cobbles, subrounded, very dense, brown, moist, Homogeneous, no HCl reaction. Core Length Recovered 1.5 ft  Poorly graded GRAVEL, with cobbles, subrounded, very dense, brown, moist, Homogeneous, no HCl reaction. Core Length Recovered 2.8 ft		
10-3			50/6" (50/6")	X	D-4 C-5		Poorly graded GRAVEL with sand, subrounded, very dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.2 ft Poorly graded GRAVEL, with cobbles, subrounded, very dense, brown, moist, Homogeneous, no HCl reaction. Core Length Recovered 2.5 ft		-
15—			24 50/6" (50/6")	X	D-6 C-7		Poorly graded GRAVEL with sand, subrounded, very dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.8 ft Poorly graded GRAVEL, subrounded, very dense, brown, moist, Homogeneous, no HCl reaction. Core Length Recovered 2.0 ft		-



Start Card S 23726

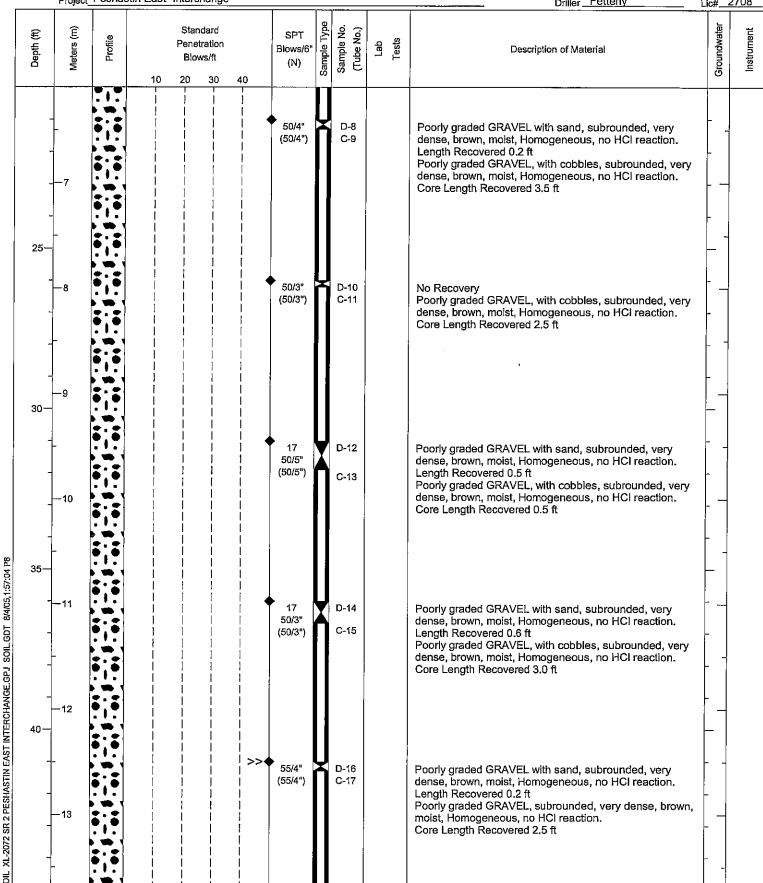
HOLE No. H-10-04

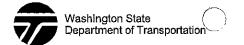
Sheet \_\_2\_\_ of .\_\_3\_\_

Job No. XL-2072 SR 2

Elevation \_1080.9 ft (329.5 m)

Project Peshastin East- Interchange Driller Fetterly Lic# 2708





Start Card S 23726

HOLE No. H-10-04

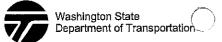
Sheet 3 of 3

Job No. XL-2072 SR 2

Elevation 1080.9 ft (329.5 m)

oject Peshastin East- Interchange Driller Fetterly Lic# 2708

Depth (ft)	Meters (m)	Profile	10	Standa Penetra Blows	ition :/ft	0	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab	Tests	Description of Material	Groundwater	
1 1 1	—14 - —15					               	19 50/6" (50/6")		D-18 C-19			Poorly graded GRAVEL with sand, subrounded, very dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.5 ft Poorly graded GRAVEL, with cobbles, subrounded, very dense, brown, moist, Homogeneous, no HCl reaction. Core Length Recovered 3.0 ft	, ,	
50	~		         	         		•	50/4" (50/4")	Ų	D-20			No Recovery	-	
55—	—16 -											End of test hole boring at 51.3 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
55	—17 -		           	]           								Bailed Hole/No Recharge		
60	—18		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1					•						
-	19			         					•					
65—	- 20												 	
-	- —21			         									-	



SOIL XL-2072 SR 2 PESHASTIN EAST INTERCHANGE.GPJ SOIL.GDT 7/25/05,6/28-10 A7

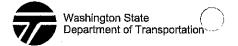
15

	Z W	/ashing epartm	ton State ent of Trar	ısportatio			LC	G OF	TEST	BORING Start Card S 23728		
•	Job No.	XL-207	72	SR	_2			Eleva	ation _108	36.3 ft (331.1 m) HOLE No. H-11-04		
	Project_	Peshas	tin East- li	nterchan	ge					Sheet 1 of 2 Driller <u>Fetterly</u>	Lic#	2708
Site	Address_	Vic of S	R2 & Blev	wwett Cu	toff Rd.					Inspector_Hanning		_
	Start <u>(</u>	October	26, 2004	Com	pletion Octo	ber 27, 2	004	lWel	IID# <u>N</u>	A Equipment CME 850 w/ autohamn	ner	_
	Station _	A 42+8	2.9		Offset 43	3 ft Rt.		Ca	ısing <u>3.</u>	5" Method Wet Rotary		_
	Northing _	705066	.236	E	asting 219	98445.15	5	Lati	tude	Longitude		
	County_	Chelan		Subs	section_SW	//NW				Section 21 Range 18 EWM Township.	24N	
Depth (ft)	Meters (m)	Profile	:	Standard Penetratio Blows/ft		SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab	Description of Material	Sroundwater	Instrument
			10	20 30	40						+	
			 								-	- -
5-	-2	08.00°C	•			1 1 4 (5)		D-1	GS MC AL	ML, M.C. = 32%, PI = 5 Sandy SILT, medium stiff, olive brown, moist, Homogeneous, HCI not tested. Length Recovered 0.8 ft Poorly graded GRAVEL with sand, very dense, gray, moist, Homogeneous, HCI not tested. Core Length Recovered 1.5 ft		
•		0.00.00 0.00.00 0.00.00	         			23 50/2" (50/2")	X	D-3		Poorly graded GRAVEL with sand, subrounded, very dense, gray, moist, Homogeneous, HCl not tested. Length Recovered 0.5 ft Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 2.0 ft		_

Silty GRAVEL with sand, subrounded, very dense, gray, moist, Homogeneous, HCl not tested.
Length Recovered 0.7 ft
Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested.
Core Length Recovered 2.5 ft

30 50/3" (50/3") D-5

C-6



<sub>Job No.</sub> XL-2072

#### LOG OF TEST BORING

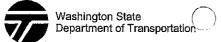
Start Card S 23728

HOLE No. H-11-04

Elevation 1086.3 ft (331.1 m)

Sheet 2 of 2

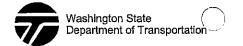
Project Peshastin East-Interchange Driller Fetterly Lic#\_2708 Sample Type Sample No. Groundwater Standard € Meters (m) SPT (Tube No.) Instrument Profile Tests Penetration Depth Гaр Blows/6' Description of Material Blows/ft (N) 50/2" D-7 No Recovery (50/2")C-8 Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 1.5 ft 25 Silty GRAVEL with sand, subrounded, very dense, gray, 28 D-9 50/5" moist, Homogeneous, HCI not tested. (50/5")Length Recovered 0.8 ft C-10 Poorly graded GRAVEL, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 2.0 ft 30 50/6" D-11 Silty GRAVEL with some sand, subrounded, very dense, (50/6")gray, moist, Homogeneous, HCl not tested. C-12 Length Recovered 0.3 ft No Recovery SOIL XL-2072 SR 2 PESHASTIN EAST INTERCHANGE, GPJ SOIL, GDT 7/25/05,6:29:10 A7 35 D-13 12 Silty SAND, with some gravel, dense, olive brown, moist, 14 Homogeneous, HCl reaction, not tested, Drilling behavior 16 indicates contact with sand at 32.5ft (30)Length Recovered 1.2 ft C-14 No Recovery 12 40 12 D-15 GS SM, M.C. = 19% 16 MC Silty SAND, dense, olive gray, moist, Stratified, HCl not 19 tested. (35)Length Recovered 1.3 ft End of test hole boring at 42 ft below ground elevation. 13 This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data. Dry hole after 1 hour wait with casing 35 ft below ground surface.



Start Card <u>S 23727</u>

Job No. XL-2072 SR 2	Elevation _1082.1 ft (329.8 m)	HOLE No. <u>H-12-04</u>
Project Peshastin East- Interchange	· · · · · · · · · · · · · · · · · · ·	Sheet 1 of 2 Driller_ <u>Fetterly</u> Lic#_2708
Site Address Near Jct SR 2 & SR 97		Inspector Nebgen
Start October 20, 2004 Completion October 21, 2004	Well ID#	Equipment CME 850 w/ autohammer
Station B 58+04.7 Offset 0.2 ft Rt.	Casing 4"x51'	Method Wet Rotary
Northing 702973.113	Latitude	Longitude

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft 10 20 30 40	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab	Description of Material	Groundwater	Instrument
-	_					C-1		Well graded GRAVEL with sand, subrounded, dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 1.5 ft		
5	<b>-2</b>			11 50/5" (50/5")	X	D-2 C-3		Well graded GRAVEL with sand, subrounded, very dense, grey, moist, Homogeneous, no HCl reaction. Length Recovered 0.2 ft Well graded GRAVEL with sand, subrounded, very dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 2.5 ft		
15—	-4	00.00.00.00.00.		12 20 45 (65)		D-4 C-5		Well graded GRAVEL with sand, subrounded, very dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 0.3 ft  Well graded GRAVEL with sand, subrounded, very dense, brown, moist, Homogeneous, no HCl reaction. Length Recovered 2.5 ft		
20	<b>−</b> 5					C-6	Ŷ	Well graded GRAVEL with sand, subrounded, very dense, brown, moist, Homogeneous, no HCI reaction. Length Recovered 2.5 ft	-	



SR \_

Job No XL-2072

## LOG OF TEST BORING

 $\bigcirc$ 

Start Card S 23727

HOLE No. H-12-04

Elevation \_1082.1 ft (329.8 m)

Sheet \_\_2\_\_ of \_\_2\_

	, , , , , , , , ,	Peshast						<u> </u>			T		Driller <u>Fetterly</u>	Lic#_2	_, _,
Depth (11)	Meters (m)	Profile	10	Pe B	tandar netrati Blows/f	ion T	10	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)		Lab	Description of Material	Groundwater	4
	_	200					1	18 50/6" (50/6")	X	D-7			Well graded GRAVEL with sand, subrounded, very dense, brown, moist, Homogeneous, no HCl reaction.  Length Recovered 0.7 ft	<b>/</b>	
_	<b>—</b> 7		[         	]		         	         			·			End of test hole boring at 21 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.	-	
- 25—	-		       	 			       						Bailed Hole/No Recharge		
-	<b>-8</b>		]				       							- <u>-</u>	
1	<b>-</b>			]			[ [     							-	
30— -	<del>-</del> 9		,         	*   	         		           								
1	10		       	     	! ] ! !		1 1 1 1			-		·			
- 2F.	-			í       	       		!         								
35—	—11		     		    -  -		       								
	-				        -		       							-	
- 10—	—12				,   		       							-	
-1	-		       	1	       		         								
-	—13			 	     		       								
	_		1	]	 									-	



Job No. XL-2072

Station A 41+28.7

# LOG OF TEST BORING

3.5"

Casing

Start Card S 23728

HOLE No.	H-13-04
HOFE MO.	• • • • • • • • • • • • • • • • • • • •

<b>-</b>	1082.6 ft (330.0 m)	HOLE NO.			
Elevation .	700210 11 (00010 111)	Sheet	1	of _	2

Inspector Hanning

Project\_Peshastin East- Interchange

Lic#\_2708\_ Driller Fetterly

Site Address Vic SR2 & Blewett Cutoff Rd.

Offset 43.1 ft Lt.

SR

Equipment CME 850 w/ autohammer

\_\_ Completion October 28, 2004 Start October 27, 2004 NΑ \_Well ID#.

Method Wet Rotary

Easting 2198380.2 Northing \_705230.675 Latitude

Longitude

	$\overline{}$	y Chelan	Subsection SV	//NM		6.0		Section 21 Range 18 EWM Township 2		*=
Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft 10 20 30 40	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	instrument
				8 8 13 (21)		D-1	GS MC	ML, M.C. = 18% SILT, very stiff, olive brown, moist, Homogeneous, HCI not tested Length Recovered 1.0 ft Poorly graded GRAVEL with silt, very dense, gray, moist, \text{Homogeneous, HCI not tested.} \text{Core Length Recovered 1.5 ft}		
1	03		>>	21 31 32 (63)		D-3 C-4		Silty GRAVEL with sand, subrounded, very dense, gray, moist, Homogeneous, HCl not tested, material change at 6.5 ft. Length Recovered 0.8 ft Poorly graded GRAVEL, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 2.0 ft		
SOIL XL-2072 SRZ PESHASTIN EAST INTERCHANGE.GFU SOIL.GDT TIZEGOSOILS OF	-5			30 50/3" (50/3")	Z	D-5 C-6		Silty GRAVEL with sand, subrounded, very dense, gray, moist, Homogeneous, HCl not tested. Length Recovered 0.4 ft Poorly graded GRAVEL with cobbles, very dense, gray, moist, Homogeneous, HCl not tested. Core Length Recovered 2.0 ft		



Job No. XL-2072

#### LOG OF TEST BORING

Start Card S 23728

HOLE No. H-13-04

Sheet 2\_ of 2\_

Elevation 1082.6 ft (330.0 m)

Lic#\_2708 Driller Fetterly Project Peshastin East-Interchange Groundwater Sample Type Instrument Sample No. Standard (Tube No.) Meters (m) SPT Depth (ft) Tests Lab Penetration Description of Material Blows/61 Blows/ft (N) 40 60/4" D-7 No Recovery Silty GRAVEL, very dense, gray, moist, Homogeneous, (60/4")C-8 HCl not tested. Core Length Recovered 3.0 ft 25 Silty GRAVEL with sand, subrounded, very dense, gray, D-9 26 40 moist, Homogeneous, HCI not tested. Length Recovered 1.0 ft 50 (90)No Core Recovery C-10 30 D-11 GS SM, M.C. = 23% Silty SAND, with traces of gravel, dense, olive brown, 15 МС moist, Stratified, HCl reaction not tested, Contact at 28ft. 17 Length Recovered 1.0 ft (32)No Core Recovery C-12 10 XL-2072 SR 2 PESHASTIN EAST INTERCHANGE.GPJ SOIL.GDT 8/4/05,1:57:05 P8 35 Silty SAND, with a trace of gravel, very dense, olive 8 D-13 17 brown, moist, Stratified, HCi not tested. Length Recovered 1.4 ft 50/5" (67/11") No Core Recovery C-14 40 SW-SM, M.C. = 13% 55/6" D-15 GS Well graded SAND with silt and gravel, very dense, gray, МĈ (55/6") moist, Stratified, HCl not tested. Length Recovered 0.4 ft 13 End of test hole boring at 41.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data. Bailed Hole/No Recharge

# TEST PIT LOG

Location		Surface Elevation	Test Pit Number		
Vicinity o	of SR-97 & Big Y Road B63+50, 25' Lt.	1093'	TP-1-04		
Project No	Peshastin East Interchange		Project Number  XL-2072		
Equipment	Ford 655E Backhoe	Date Started 10/21/04	Date Completed 10/21/04		
lev — epth	Desciption		Remarks		
	Sandy SILT with some gravel, brown, moist, homoge	eneous, HCI not tested.	GS Bag soil sample (B-2) taken at 2ft below ground surface  Cobbles and boulders measured		
1083ft 10ft	Poorly graded GRAVEL with cobbles and bo brown, dry to slightly moist, homogeneous, HCI	oulders, not tested.	Cobbles and boulders measure between 0.5 to 2 ft in diameter  Cobbles and boulders size increased with depth.  Excavation difficulty increased with cobble and boulder size.  GS  Bag soil sample (B-1) taken at		
1078 <u>ft</u> 15ft	Test Pit completed at 12ft below ground elevation.  No groundwater seepage observed  Severe caving observed between 5.5 and 12 feet below  This is a summary log of a test pit. Soil/Rock description visual field identifications and laboratory test data.		11ft below ground surface		

**APPENDIX B: Laboratory Results** 

				•													
3	Job No.	XL-2072.			Dafe	July 21, 2005	05				,			č			
	_	H-1-04			Sheet	-		Гa	iboratory	Laboratory Summary		\$ C	'ashingto enarfmei	on State of Trai	Washington State Department of Transportation		٠
<u> </u>		Peshasi	Peshastin East- Interchange	terchange					`	•						5	
<u> </u>	<u></u>	Depth: (m)	Sample No.	- SOSN		Color		ļ	Description	ption			MC%		PL	₫	
•		1.83	D-3	SW-SM	See	See Boring Log	\$	VELL-GR/	ADED SAND v	WELL-GRADED SAND with SILT and GRAVEL	RAVEL		10				
H	13.0	3.96	D-6	M	See	See Boring Log			SANDY SILT	SILT			. 29	•			
4	18.0	5.49	80	GW-GM	See	See Boring Log	W	VELL-GRA	ADED GRAVE	WELL-GRADED GRAVEL with SILT and SAND	SAND		10				. (
									!		ļ	. ,	-				0
		-															
1				-	Sn	US Sieve Opening In Inches	ches	S SN	US Sieve Numbers	<b>(</b> 0		Hydrometer Analysis	ter Analy	/sis			
	GRADA	NOIT	GRADATION FRACTIONS	SNC	100	3" 3/4"	- ## [ ]	0 <del>1</del> <del>1</del> <del>1</del> 1	#40	-	#200			-	-		
	%Gravel	%Sand	%Fines Cc	J J	06										-		
•	39.7	48.4	11.9	1.7 98.1	à					B							
×	0.0	36.3	63.7							H							
4	47.6	44.0	8.4 1.4	4 59.1													
					eW γε												
					∃ neri= R	0									-		
	GRAI	DATIO	GRADATION VALUES	S	Percent l	0											)
	090	D50 [	D30 D20	D10	ri č	OS C											
•	4.658	2.48	0.61 0.27					·	<b>4</b>		•			•			
H					10	0					*					1	
◀	6.952	4.13	1.08 0.47	0.118	-	0 5 4 3 2	108 543	<b>N</b>	1 8 5 4	3 2 0.1	0.18 5 4 3	2 0.	0.018 5	8	2 0	0.001	
						:			Grain Siz	Grain Size In Millimeter	er					٦	
						i di seri			Sand			i di	Silf and Clay				
		-				Grave	Coarse		Medium	Fine		5	20.0				

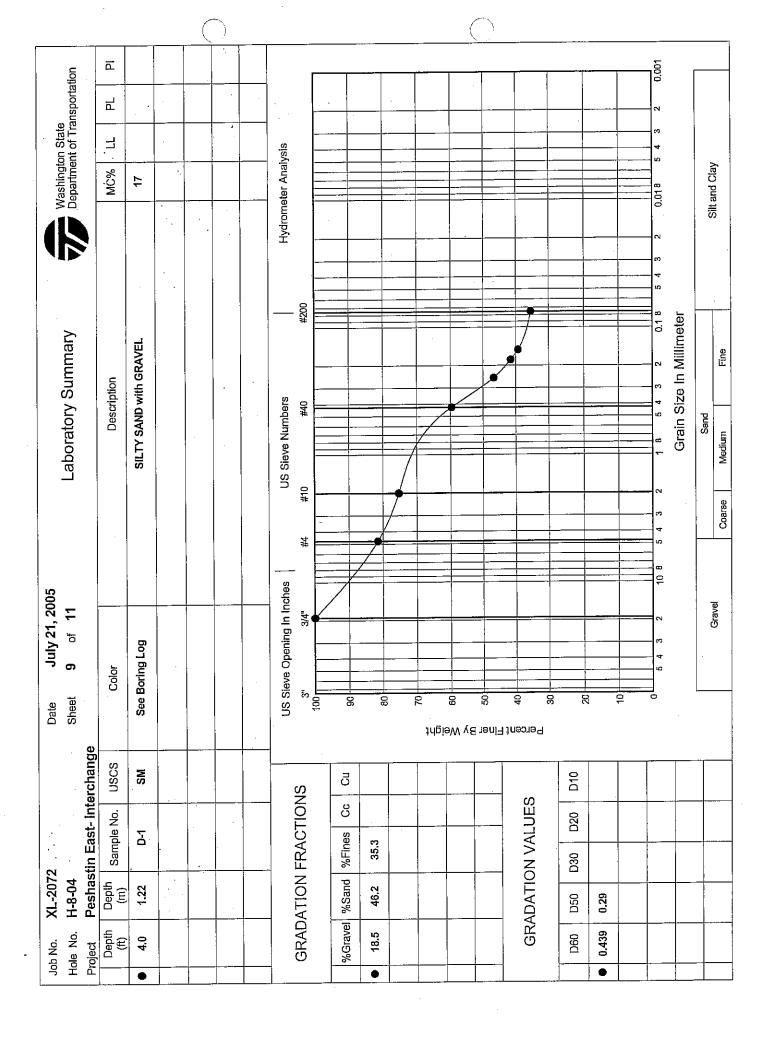
	Job No.	XL-2072	2			Date July	July 21, 2005		Washing	ton State		
	Hole No.	H-2-04	1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -			Sheet 4	of 11	Laboratory Summary	Department of Transportation	ent of Tra	ansporta	lion
-	Project Depth	Peshas	Depth Sample No 118CS	- Interc	rcnange	Color		Description	MC%	1	1	┫
	Œ	<b>E</b>		+	3				-			Ì
•	0.0	0.00	7		SM	See Boring Log	<b>D</b>	SILTY SAND	<b>£</b>		1	
	4.0	1.22	D-2			See Boring Log	   _p	SILT with SAND	17	34	23	œ
◀	9.0	2.74	4	S	SP-SM	See Boring Log	<b>D</b>	POORLY GRADED SAND with SILT and GRAVEL	6			
☆	12.0	3.66	. 0-5	<u> </u>	GW-GM	See Boring Log	D D	WELL-GRADED GRAVEL with SILT and SAND	6			
0	17.0	5.18	D-7	Ó	GW-GM	See Boring Log	<b>D</b>	WELL-GRADED GRAVEL with SILT and SAND	7			
	GRAD	ATION	GRADATION FRACTIONS	SNOI		US Sieve Opening In Inches	ning In Incl	hes         US Sieve Numbers         Hydrometer Analysis           #4         #40         #200	neter Ana	llysis		_
1	%Gravel	%Sand	%Fines	පි	ਰ	06						
•	1.0	51.4	48.5			8						
H	1 0.0	27.6	72.4			2	*8					
◀	30.4	63.7	5.9	0.9	18.1							
-}≭	54.1	38.3	7.5	1.1	75.5	89 We						<u> </u>
0	9.99	36.8	6.5	7. 5.	58.1	raniन :						<del> </del>
	GR/	ADATIC	GRADATION VALUES	JES		Percent						· · T
	D90	D20	D30 D2	D20 D	D10	50						
•	0.165	0.08									-	
M						2		3				
	2.924	1.77	0.65 0.3	0.38 0.7	0.162	0 5 4	3 2	5 4 3 2	0.018	5 4	- 2	0.001
⋠	ر 10.852	6.04	1.31 0.	0.50 0.7	0.144			Grain Size In Millimeter				Γ
•	11.871	6.84	1.89 0.	0.70 0.3	0.204		Gravel	Coarse Medium Fine Sitte	Silt and Clay	,		
_}												

	_	Ы																	0.001	_	
	Washington State Department of Transportation	PL		•															- 2		
	gton Sta	, Lí					alvsis												5 4 3		
-	Washin Departn	MC%	15	10	6	6	Hydrometer Analysis												0.018		
							Hvdron												4 3 2		
	mary	į	AVEL.	POORLY GRADED SAND with SILT and GRAVEL	WELL-GRADED GRAVEL with SILT and SAND	POORLY GRADED SAND with SILT and GRAVEL		#200									,		2 0.18 5	Alllimeter	_
	_aboratory Summary	Description	SILTY SAND with GRAVEL	D SAND with S	GRAVEL with	D SAND with S	Nimbers	#40										<b>A</b>	8 6 4 3	Grain Size in Millimeter	Sand
	Labor		SILTY	OORLY GRADE	VELL-GRADED	DORLY GRADE	Sieve Numbers	#10									/		2	ָט פֿי	
				   <mark>A</mark>		)A		# #		7									8 5 4 3		
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	XL-2072 H-3-04 Peshastin East- Interchange	nscs	WS.	SP-SM	GW-GM	SP-SM		ठ	ਠੋ		50.8	39.1	24.5			010		0.141	0.276	0.156	
	st- Inte	Sample No.	D-2	D-3	40	9-0		STION	ပိ		0.6	1.6	0.9	_	LUES	D20		0.38	98.0	0.39	
	72 Stin Eas	Sampl		Δ	<u> </u>			GRADATION FRACTIONS	%Fines	20.2	6.5	5.1	5.6		GRADATION VALUES	D30	0.21	0.78	2.18	0.71	
	XL-2072 H-3-04 Peshast	Depth (m)	1.22	2.13	2.74	4.27		ATION	%Sand	58.4	46.8	39.9	58.6		\DATI	D20	0.56	3.55	6.25	2.28	-
	Job No. Hole No. Project	Depth (#)	4.0	7.0	9.0	14.0		GRAD	%Gravel	21.4	46.6	55.0	35.8		GR4	D90	1.036	7.155	10.788	3.830	
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į	chanç	nscs	S D	ŊS B			m	ਰ	35.8	31.5					D10	0.195	0.291				
	- Inter	- O V					Ñ OL	ర	0.4	1.3				UES	D20	0.37 0	0.79			-	
	Peshastin East- Interchange	Sample No.	돌.	8-0			RAC	%Fines	4.8	4.6				GRADATION VALUES		-	_			+	
XL-2072 H-4-04	hastin	oth (s	9	2			E N		φ.	_				NOIL	D30	0.69	1.84			+	
XL-207 H-4-04	Pes		-	6.10			JATK	el %Sand	50.6	37.1				ADA.	D20	2.82	6.40				
Job No.	Project	Depth (ft)	2.5	20.0			GRADATION FRACTIONS	%Gravel	9.4	58.3				G.R.	D90	996.9	9.174				
일			•	B				3,	•	H						•	×				

목 운 현	Job No. Hole No.	XL-2072 H-5-04	XL-2072 H-5-04 Boshaetin East- Interchande	forchange	Date July 21, 2005 Sheet 7 of 11	Laboratory Summary	Washington State Department of Transportation	5	
	Depth (ft)	Depth (m)	Sample No.	SOSO	Color	Description . MC%	LL PL	딥	
•	2.5	0.76	5	SM	See Boring Log	SILTY SAND with GRAVEL			
H	10.0	3.05	4-0	Ф	See Boring Log	POORLY GRADED GRAVEL with SAND	41 37	4	
4	15.0	4.57	9-Q	GP-GM	See Boring Log	POORLY GRADED GRAVEL with SILT and SAND 12			· · (
*	20.0	6.10	D-7	GM	See Boring Log	SILTY GRAVEL with SAND 13			
					IIS Sleve Opening In Inches	nches US Sieve Numbers Hydrometer Analysis	Vsis		
<u></u>	GRAD	ATION	GRADATION FRACTIONS	SNC	3" 3/4" 3/4"	#4 #10 #40 #200	   		
	%Gravel	%Sand	%Fines Cc	5	06				
•	34.8	47.7	17.5		08				
×	76.9	19.9	3.2 4.9	9 28.1					
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Ħ	13.908	10.40	5.81 1.91	0.494	0		*		
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	XL-2072 H-7-04	San					_	Z Z	d %Fines	16.5	10.5				NO.	D30	0.31	0.54				
٠.	XL-2072 H-7-04	Depth (m)	1.68	10.82				GRADATION FRACTIONS	%Sand	61.6	51.1				GRADATION VALUES	D20	0.82	2.39				
		-	5.5	35.5				RAD,	%Gravel	21.9	38.4				GRA	090	1.384	4.325				$\dashv$
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	XL-2072 H-13-04 Peshastin East- Interchange	Depth S <sub>c</sub>	1.37	9,45	12.50			GRADATION FRACTIONS	<u> </u>			59.0				GRADATION VALUES	) D30			5 0.48		
			<del> </del> -				'	DATI		vel %Sand	12.8		60.7			RADA	D50		5 0.11	1.45		
	Job No. Hole No. Project	Depth (ft)	4.5	31.0	41.0			GRA		%Gravel	0.0	5.1	30.2			ច	D60		0.135	2.592		
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Washington State Department of Transportation	MC% IL PL			Hydrometer Analysis	2 2 0018 5 4 3 2 2	
5 Laboratory Summary	Description	SILT with SAND	WELL-GRADED GRAVEL with SAND	les US Sieve Numbers	2 2 2 3 2 0.18	Grain Size In Millimeter
Date July 21, 2005 Sheet 11 of 11 je	Color	See Boring Log	See Boring Log	US Sieve Opening In Inches	Percent Finer By Weight	
terchang	nscs	M	В	SNS	S 74.9 B 1.369	
XL-2072 TP-1-04 Peshastin East- Interchange	Sample No.	B-2	F2	GRADATION FRACTIONS	60 D50 D30 D20 5.49	
XL-2072 TP-1-04 Peshasti	Depth (m)	0.61	3.44	ATION	ADATIOI D50 F 73.95 24	
Job No. Hole No. Project	Depth (ff)	2.0	11.3	RAD	GRA 102.569	

APPENDIX C: Images of Recovered Core Samples and Test Pit Excavation



Figure C.1: Gravel and Cobbles
Boring: H-1-04

Depth: 15 ft



Figure C.2: Gravel and Cobbles
Boring: H-1-04
Depth: 25 ft



Figure C.3: Boulder Boring: H-2-04 Depth: 29.9 ft



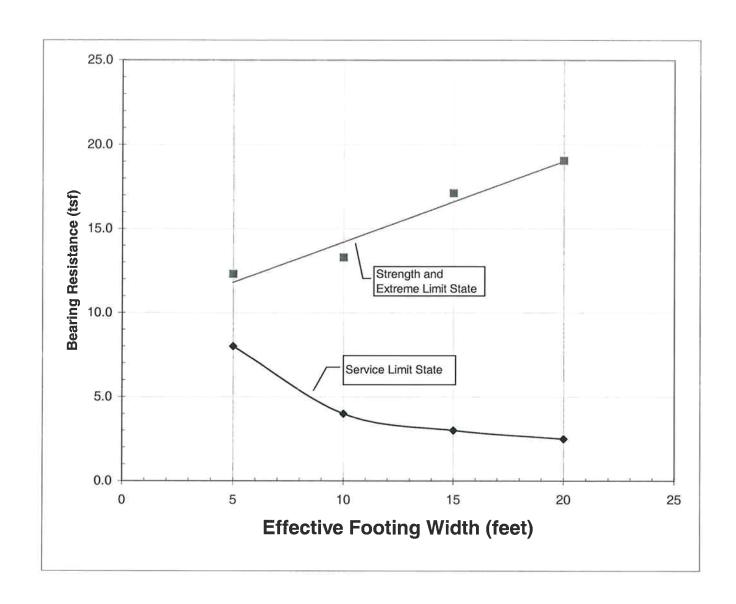
Figure C.4: Test Pit Excavation
Test Pit: TP-1-04
Depth: 0-8 ft



Figure C.5: Cobbles and Boulders Excavated From Test Pit
Test Pit: TP-1-04
Depth: 0-8 ft

**APPENDIX D: FOUNDATION CAPACITY CHARTS** 

# Nominal Bearing Resistance vs Footing Width US-2/US-97 Bridge Abutment Piers 1 and 2



# Nominal Bearing Resistance vs Footing Width Equipment Under-Crossing Bridge

